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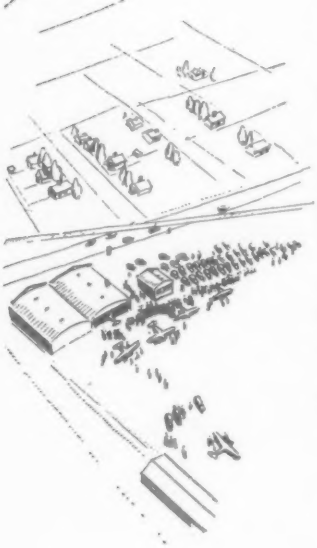

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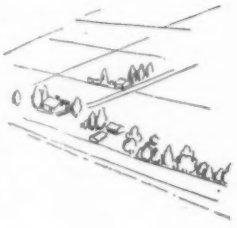

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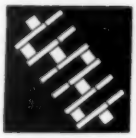

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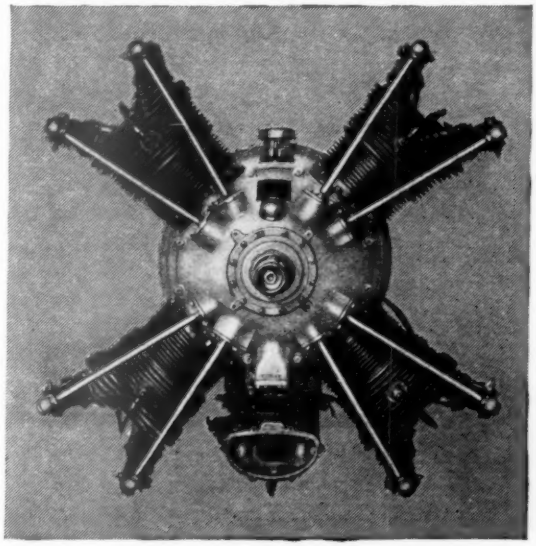

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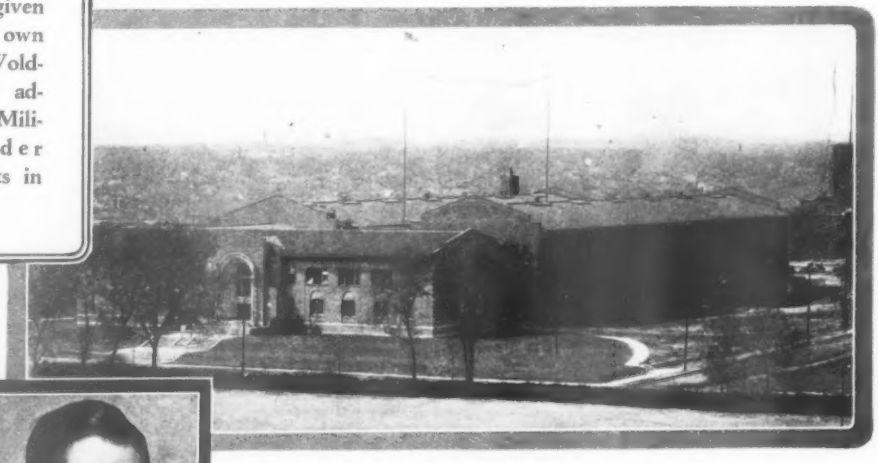

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Published Monthly

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Alfried Gymnich

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CONTENTS

Has Aviation a Future? 9
Crop Survey by Airplane 11
War Thrills in Peace Time 15
Extra Flying Money 19
Cloud Signs on Aerial Highways 20
A Forced Landing 24
Current Comment 26
Switzerland in the Air 28
Forest Fire Fighting 32
Avigation 35
Books on Aviation 36
National Air Tour 38
Cadet Life at Brooks Field 40
Pioneer Air Pilots 46
What Aviation Means to Women 52
Pictorial News 56
Construction of Sailplanes 60
What's Doing in Washington 66
Aero Club News 68
Problems of the College Aero Club 72
The Sick May Fly 74
Model Builders' Department 82
Directory 94
Classified 96
Aeronautical Library 95
Advertisers' Index 98

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Has Aviation a Future?

THE art of flying has been much hurt by air enthusiasts, I admit. There have been too many predictions that have not yet come true. That is why many of us try hard to steer a middle course. But for all my conservatism I am confident that flying has a future as yet undreamed of, and that in a few years these hot blasts now issuing against it will read as foolishly as do the original arguments against the railway and the automobile.

Though I look for no immediate spectacular advance in flying, I do believe that design will be slowly improved, performance enlarged, and safety increased every year. Only the other day there was announced in England an item of design in the form of wing slots that would automatically prevent a plane from going into a tail spin. There may be devised a means of lightening a plane's load automatically in case one of its several engines stalls. And so on.

Performance is a more complex matter, because it takes into account speed, cruising radius, and maneuverability. Commercial planes now usually work at speeds of from sixty to ninety miles an hour. In a year these limits should be from one hundred ten to one hundred fifty miles an hour. Probably two hundred miles an hour will be the limit in a few years. Cruising radius will be increased when fuel consumption is improved and structural weight reduced. Both are going on in a small way every day.

Maneuverability is something we know relatively little about. But there are being held important tests in nearly all aircraft plants and in our military service that will make planes more docile in the air and safer in taking off and landing.

I think the so-called "flivver," or small private plane, is practical today and will soon be built in quantities at a cost of from $1,000 to $2,000. The popular size will carry two or three passengers and be built for safety rather than for speed.

The greatest progress—and the development that will mean most to aviation—must come from banking support. So far this support has been very limited, but it is increasing markedly as more successful flying is done. When American business joins hands with American aviation, the future of flying is assured.

Commander Richard E. Byrd, U. S. N., in a debate with Captain Alfred C. Dewar, published in the Forum Magazine, August, 1928.

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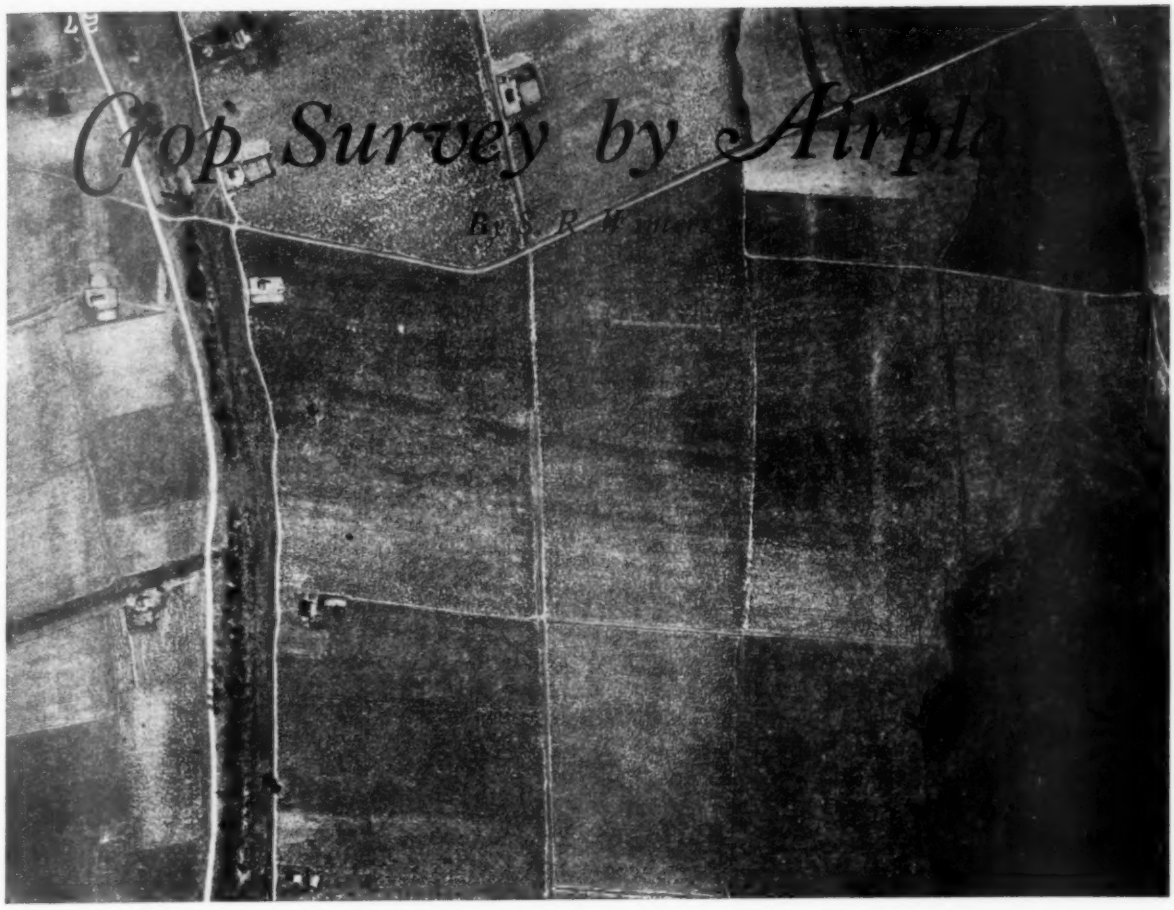
Crop Survey by Airpla

By S. R. W[illiams]



Cotton fields, with a few small patches of corn near Tallulah, La. Note the bayou with highways on both sides.

IT is a far cry from the crop reporter who travels in automobile, buggy, wagon, or even on foot, to the counter of our agricultural acres who, speeding aloft at 100 miles an hour, visualizes the extent and condition of corn, cotton, tobacco, hay, rice, etc., through the "eyes" of an airplane camera. While no appreciable number of the approximately 250,000 crop reporters may be expected to abandon the primary and time-honored questionnaire method of counting acres for the new swift and sweeping mode of travel, there are interesting possibilities in the use of aircraft for making acreage estimates.

Counting crop acres by airplane is in the category with mapping from the air, sowing tree seeds, fighting forest fires, and spraying insecticides—that is, it is an adjunct to, rather than a substitute for, the older and proven methods. Where cotton, corn, tobacco, or other crops have been wrecked by hail, wind, or storm the airplane, for example, offers a speedy and relatively accurate means for measuring the toll. Similarly, where an inspection of crops with reference to their relative condition during the growing season is desirable the flying machine can make a sweeping survey and render the information available quickly. Slower modes of travel and less speedy methods of making a survey might invalidate the timeliness of the desired data. Or, when, Uncle Sam needs to know the yearly changes in acreage devoted to certain crops the airplane offers, at least, quick service as an ally of the conventional methods of crop estimating.

Speculative as these potential uses of aircraft in making agricultural surveys may seem, there are past experimental efforts which suggest their feasibility—if the cost is not prohibitive. The Division of Crop and Livestock Estimates of the Bureau of Agricultural Economics, United States Department of Agriculture, has already experimentally applied the flying machine to crop estimating—noting the extent and condition of the rice fields of an entire parish in Louisiana; observed from aloft some of the cotton fields in North Carolina, and Mississippi, and made a flying investigation of the damage wrought by leaf worms in Arkansas and Mississippi. And, again, a panoramic view of wheat and rye crops in Ohio.

"While to the man who has never 'been up' it always seems a trifle preposterous that from an airplane traveling a mile or more a minute one may make a satisfactory inspection of fields," notes Charles E. Gage, agricultural statistician, "yet the experienced air traveler knows that when flying at low altitudes the opportunities for critical study are unsurpassed by any other method of travel. To be sure, one can not get down on his marrow bones and turn his gaze upon the individual worm as it haply gnaws a leaf, but what is vastly more important, his sweeping vision may encompass whole fields and many of them, taking in detail and mass impressions not possible from ground inspection. If the

Flying over a cotton field in Mississippi delta.

worms are present in numbers their presence is pretty certain to be revealed in the color and relative density of the foliage. In fact, the healthfulness of the crop, the clearness of the moisture condition of the soil, and more general factors, such as the progress of farm work, are most readily apparent."

The physical equipment employed in the experiments of counting crop acres from the air consisted of a borrowed army airplane, a Fairchild camera, and a 75-roll of hyper-sensitized film, making exposures approximately 7x9 inches in size. Curiously enough (since airplane side views are not satisfactory) the camera is mounted vertically over an opening in the floor of the fuselage. The altitude at which the photographs are taken vary from 300 to 10,000 feet—with the lower figure proving more satisfactory for minute studies of crops. At an altitude of 10,000 feet, the photographs are useless for studying crop conditions. The camera is operated mechanically and the photographs are made at such intervals as are necessary to obtain a complete series for the strip of territory being visualized. The frequency of exposures—that is, the time intervals between exposures—is governed according to the altitude from which the pictures are made—decreasing in frequency as the higher altitudes are attained. The camera is equipped with a ray filter as a means of eliminating the effects of haze. During a three hours' flight 500 square miles of crops were photographed. At an altitude of 10,000 feet a picture represents an area of about one and one-half square miles.

Crop estimating from the air is not confined to the observance of apparently miles of level country, and indulging in mathematical calculations—there are thrills a-plenty for the crop reporter who turns aviator, as witnessed by the following flight accounts in the files of the United States Department of Agriculture.

"The sky was filled with cloud masses and 'thunder heads' were interspersed with blue sky and sunshine. An elevation of three to four thousand feet was maintained from which vantage as many as six or eight separate thunderstorms were visible, some near and others miles away. The airplane circled around for a long time, keeping out of the way of a rapidly moving storm, and finally headed squarely into the upper part of it, emerging in a few minutes into bright sunshine on the other side. For the time being, however, the flyers were completely walled in, with only occasional glimpses of the ground below. After coming out on the other side, the pilot looked back at the storm, and expressed his contempt.

"The climax of the ride was a view of a complete rainbow, the broad bands of color describing a perfect circle, the lower edge of which seemed to rest on the ground far below the plane. From that point the circle appeared to be tilted at an angle of about 30 degrees to the earth's surface and extended above the horizon. It was a scene of remarkable beauty.

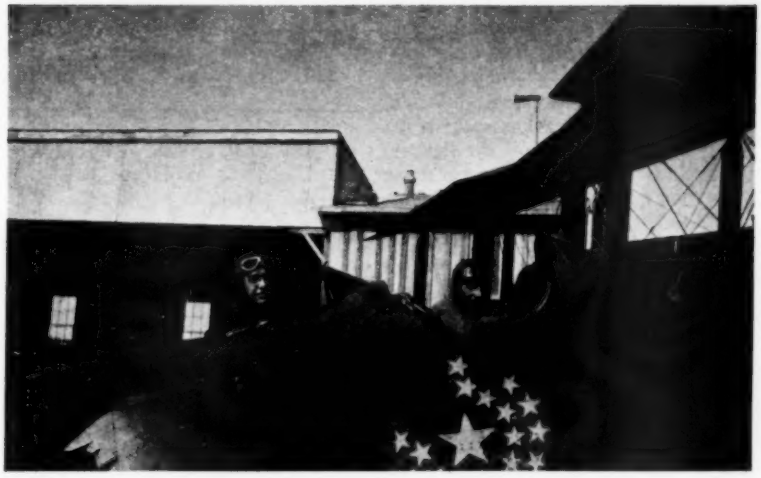
"On another trip the photographer had the thrill of executing wing-overs at an altitude of 10,000 feet. In this maneuver the plane goes through about one-third of a loop and then turns sidewise with one wing tipped downward, and sideslips anywhere from a few hundred feet to a thousand. Gradually the nose points downward and the plane straightens out in a graceful curve heading in the direction from which it came. It gives one a wonderful opportunity to stand on his head and view the earth. One's first experience is disconcerting, but not such as to endanger the nation's food supply. This is the method adopted for losing altitude rapidly without straining the ship; the only strain being from the photographer's frenzied but wholly unnecesary attempt to hang on."

Once the aerial camera has visualized crops of cotton, corn, hay, tobacco, and rice, there are two avail-

Rice country near Lake Charles, La. Note the shocks of rice. Taken from 3,000 feet elevation.

able methods for computing the acreage. The simpler of the two is a field count of the various crops photographed and rough ratios are derived. The other method, more complicated, is to calculate the actual area in each field photographed and arrive at ratios. The altimeters on aircraft disclose the varying elevations of flight, and this factor enters into the calculation of the area covered by the photograph. The second factor of calculation is the focal length of the camera—that is, the distance, in inches, between the lens and the film. With knowledge of these two factors, in order to determine the area it is only necessary to multiply each dimension of the photograph, in inches, by the elevation, in feet, and divide the result by the number of inches in the focal length of the camera. The resulting figure represents the number of feet each way of the area photographed.

How can a field of cotton irregular in shape be estimated with any degree of precision? A satisfactory answer to this question involves the use of an instrument known as a planimeter. The latter is designed for the peculiar purpose of measuring plats of irregular dimensions, Resembling a compass, the planimeter is placed flat upon an aerial photograph, one point of the compass is stationary, and the needle-point of the other is traced in a clockwise motion around the boundaries of the fields. A friction wheel at the apex of the compass moves backward and forward according to the direction in which the needle-point is moved, and this results in a reading on the scale in square inches. Unfortunately the hill and the valley appear the same through the impressions of aerial photography.



Charles E. Gage, U. S. Department of Agriculture, is the passenger about to make a crop estimating trip.

"The rather spectacular nature of crop estimating from airplanes," cautions Mr. Gage of the Bureau of Agricultural Economics, "makes it subject to the danger of distorted press references and the impression is apt to gain currency that the Department of Agriculture is proposing to substitute aerial photography for the older methods of acreage determination. To avoid this, we are always careful to point out that our attitude toward photographic surveys is the same as our attitude toward any other new idea for arriving at crop acreages which presents itself, namely that we are interested in developing its full possibilities as an adjunct to or check upon our present method of inquiry."

This word of caution by Mr. Gage finds a counter statement in his outline of the potentialities of the flying machine for estimating crop acres. In fact, he is of the opinion that these potentialities may amount to "superior opportunities" if three factors of air travel are taken into consideration. They are:

(1). In looking down upon crops all parts of a field pass in review at approximately the same distance from the eye and at the same speed. In viewing the field from a train or car, the nearby rows pass at an apparent high speed, appear blurred, and more or less obstruct the view of other portions of the field. The difference in this respect is striking.

(2). The area which may be inspected in a given time by flying is enormously greater than by any other mode of travel. This is particularly important in times of extensive flood, wind, or hail damage, when, ordinary means of travel are interfered with and when a rapid inspection by a trained observer would forestall many wild estimates of damage sustained.

(3). Whereas train window and automobile observations are severely limited, the air passenger may disregard highways and include the hills and dales in back of beyond.

"This is an attempt," concludes Mr. Gage, "to outline briefly the

Crop survey airplane photograph made in Louisiana.

legitimate scope of the application of airplanes to crop estimating work. While as a matter of fact, very little use has been made of them, due in part, perhaps, to reluctance of field employees to incur the hazards of air travel, nevertheless the field is there and as planes become more numerous and available, and the idea of flying becomes more commonplace, it is reasonable to assume that they will become more widely used in crop estimating and other activities." Another observer, in appraising the capacity of aircraft for making sweeping crop surveys, declares that "The fields spread out before one as the pages of an open book, and are as easily read."

"Aside from the use of airplanes in the manner described," points out the United States Department of Agriculture, "there is unquestionably a valuable field for airplane travel in the study of crop condition. B. R. Coad of the Bureau of Entomology field station at Tallulah, Mississippi, has had occasion to use the airplane almost constantly in the country surrounding Tallulah and has had an unusual opportunity to observe conditions throughout the crop season. He has emphasized the possibilities of studying conditions, by which may be understood the condition of and stand of the crop, the state of cultivation, and the moisture condition of the soil. The effect of insect infestations and crop disease are clearly apparent, especially from altitudes of 300 or 400 feet to 1,500 feet. This fact, taken in conjunction with the immense territory that can be covered in a day's flight, is decidedly significant."

Using a planimeter to compute areas of the fields shown in the aerial photo.

Safety Devices for Flying

The Assistant Secretary of War, F. Trubee Davison, made the following announcement recently:

Within a few months the Army Department hopes to have installed and in use, no less than six radio beacon stations in this country besides one in Panama and one in Hawaii. These beacons will be at San Francisco, California; San Antonio, Texas; Uniontown, Pennsylvania; Dayton, Ohio; Mitchel Field, Long Island; and Washington, D. C. The six beacons will provide several combinations of airways that will be undisturbed by clouds, and proof against fog. The beam of the radio beacon can, like a searchlight, be thrown in any direction and can be made in lengths that vary from less than 100 to nearly 2,000 miles.

The radio beacon enables the pilot, in weather of poor visibility, to fly entirely by ear. When he is on his exact course he hears the letter "T" which comes through in regular intervals. If he turns off his course, the letters "N" or "A" sound, for right and left, respectively. The pilot does not have to become an expert with the code, as it is easily remembered. The principle of operation is that the beacon sends three signals which run parallel to each other like fingers extended from a hand.

The Army Air Corps engineers are doing all they can to lessen the handicaps of the pilots who fly through bad weather, and so that this type of work may encounter no hindrances, the government has been liberal in its contributions. The aviation field owes much to these men who have directed their efforts towards improving safety factors in flying. The experiments which they have performed have been an immeasurable aid to both the manufacturer and the pilot.

Two of the most important experiments in that connection are the new landing altimeter and a system of leader cables. The former differs from the old style instrument in that it gives the exact distance between the plane and ground objects. The value of this new height recording device becomes apparent when one considers the predicament in which pilots find themselves when flying or trying to land in a heavy fog, or at night. The old altimeter works by atmospheric pressure, and many times while the instrument recorded 1,000 feet over sea level (the zero of the altimeter is sea level) the plane was only fifty feet away from high trees or hills, and when trying to land, would head into catastrophe. The value of the capacity altimeter is that it tells the pilot exactly how far he is above ground objects. If one of these instruments is lifted above a desk it will show exactly how high it is being held. While it is still in the experimental stage, much can be expected of it.

The "leader" cable is also a recent invention. This device is designed to reduce dangers in bad weather landings. It has been used in Europe and is now being put through a series of wires that radiate from the center of the airport like spokes from a wheel. Each cable or spoke sends, at various intervals, signals informing the pilot who is about to make a landing, how to govern his descent and even tells him when to put his wheels on the ground.

These various devices, when perfected, will contribute to the safety of the pilot who is obliged to make a forced landing, or has lost his way in a dense fog. Fog has been one of the greatest enemies to advancement of flying and when this danger is reduced, the pilots need not fear weather conditions of any character.

War Thrills in Peace Time

By Donald B. Phillips

IT was as if an anti-aircraft shell had blown the airplane's engine to bits. As the propeller burst, twenty whirling tons of centrifugal force ripped, shattered and tore shaft and cylinder, crankcase and rod. Only the instinctive reactions of the dazed pilot brought the craft under control.

A minute before, the two flyers were speeding along just under the damp gray clouds. Not far below, the long billows of the slate-green Atlantic moved slowly and dully towards the smudgy Delaware shore-line. It was very definitely "dirty weather." Stray drops of rain whipping across the windshield had clouded the goggles of the pilot crouching behind it. Intent on reaching an airdrome before the fog could close down, he peered intently through the mist, while his passenger in the rear seat humped over half asleep. Then—

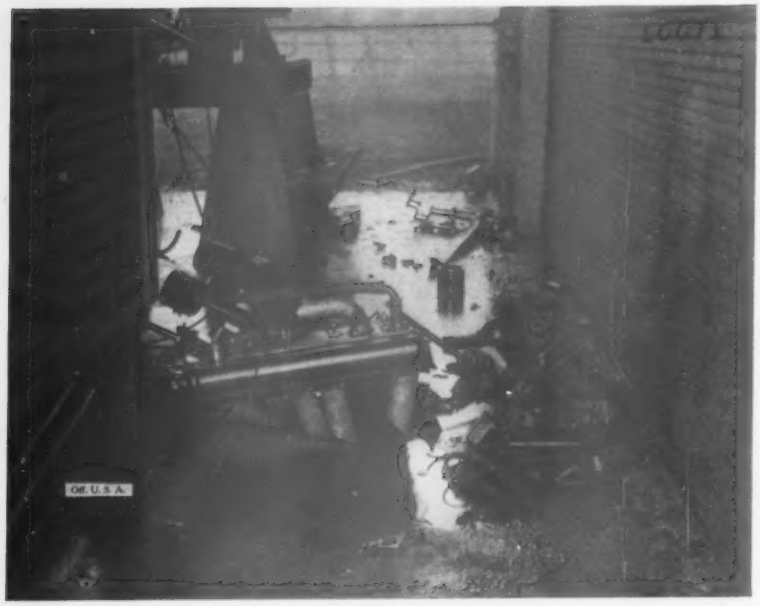
Suddenly, chaos and blindness, a crashing roar, a sense of shaking, tearing disintegration of the very vitals of the airplane, a stifling odor of heated oil, a strange unaccountable weight on the control-stick. Through a dense burst of smoke objects barely recognizable as bits of smashed engine were glimpsed in flight. The roar passed, snatching away with it the comfortable purr of the engine. Emerging from the smoke-cloud with faces and goggles streaming with oil and only the faint whistle of the wires sounding in deafened ears, they planed helplessly toward the water. As they neared it, the pilot pulled the control-stick back; the ship plumped in with a blinding burst of cold salt spray, bobbed up, and floated tail-high.

A friendly fishing-boat picked up the airmen and landed them safe and sound ashore. Their telegram to the headquarters of the Army Air Corps set many wheels in motion. It was not the first time that one of the new metal propellers had burst in flight and torn the engine to bits. Something had to be done to keep such accidents from marring the splendid record of accident prevention that was being established by the Air Corps.

To understand what was done, one needs to know what a propeller is and how it works. Of course, everyone knows that the propeller is the thing o the front of the airplane, that goes around with a loud noise and blows dust in one's eyes as the machine turns around for the take-off. But there are other viewpoints.

To the pilot, the propeller is the thing that the mechanic pulls to start the engine. Once started, its speed lends invisibility, and he does not think of it again until his right leg becomes numb from holding the rudder-bar against the unbalanced pull of the swirling blast of air that comes back from the propeller and is called the slip-stream.

To the mechanic the propeller is a treacherous beast that is always ready to leap from his hands and shatter arm or leg incautiously put in its path; and the leash upon which he must depend for its restraint is the slender ignition wire



A bursting propeller completely wrecked this engine. Note crankshaft in background with one propeller blade attached.

running to the switch controlled by the pilot as he sits in his cockpit. Even when the switch is "Off" and the engine cold, experienced mechanics do not stand under the propeller, for this is unlucky, like walking under a ladder.

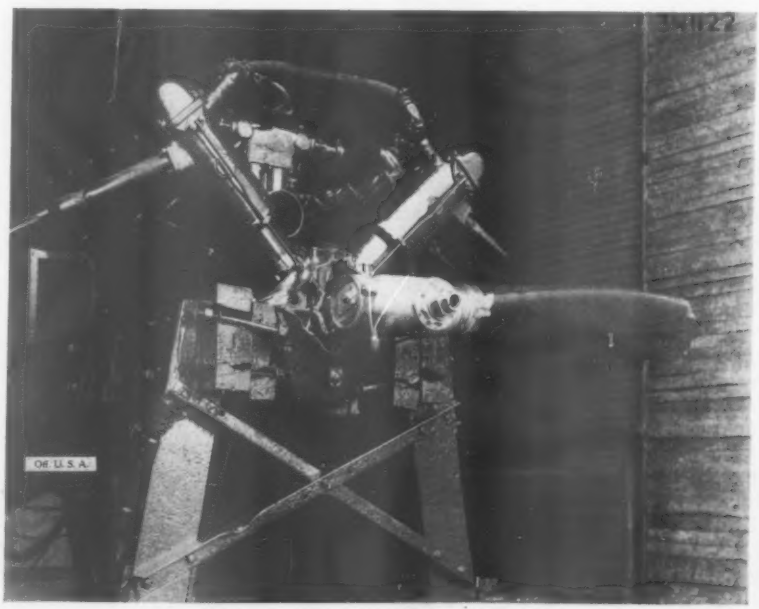
To the surgeon the propeller is a huge whirling invisible cleaver that can amputate limbs more quickly than he, though not so neatly. Cases are on record wherein individuals have committed suicide by throwing themselves into propellers of airplanes standing on the ground. A quick death, but rather mussy.

To the aeronautical engineer, the thousand-pound forward pull of the propeller is like a sum of money that must be stretched to cover more than it can possibly buy. This pull is all that he has wherewith to overcome the air-drag of wings and fuselage, struts, wires and wheels. When the airplane that he has nursed into being from the first rough sketch is at last completed and leaves the earth, every bit of air resistance here and there takes its toll from the propeller-pull, and holds down the speed. And the cry is always "More speed! More speed!" How many laymen have any conception of the days and nights that the designer slaves at his drawing-board, scheming how to eliminate this part, how to pare down another, how to squeeze something else inside the already overcrowded fuselage. All done that the precious propeller-pull may be hoarded for the task of drawing the wings to the highest possible velocity.

To the moving picture director, the propeller, commonly called the "prop" by flyers, is also a most convenient "prop" in the theatrical sense. The gentleman of the shirt sleeves, reversed golf-cap and megaphone discovered long ago that propellers produce small but potent hurricanes, which can be used to toss things about and produce various novel and striking effects. Hence he has invested in antiquated but still serviceable propeller-and-engine combinations, without any airplanes attached to them, which he calls "Windmakers." These are placed just outside the field of the camera. A few shovelfuls of sand tossed into the airblast create a howling Sahara storm; a firehose turned into it produces a tropical cloudburst illusion; or by substituting a garden hose the scene may leap the seas and land in a driving Spring shower in some temperate clime.

Until recently, virtually all propellers were constructed of wood, and failures through bursting in the air were almost unknown. The airscrews used for the great fleets of planes employed in the World War were made of walnut, birch, mahogany or other wood, and were very trustworthy. They broke if the blades hit chunks of mud thrown from the wheels while rolling, but rarely made trouble in the air except in the case of one particular type of airplane, the French "Salmson," used extensively at the Front during the World War. The Salmson had a bad trick of breaking the bolts which attach the propeller to the engine. The loss of one or two bolts did not matter, since eight are provided; but the bolt-end invariably dropped so as to be struck by the whirling propeller, thereby breaking a strip of wood from the edge of one blade. A mere sliver of wood weighing a few ounces; but this small loss

Another engine wrecked by bursting propeller. Not revolving as fast as in preceding picture, but note broken crankcase.

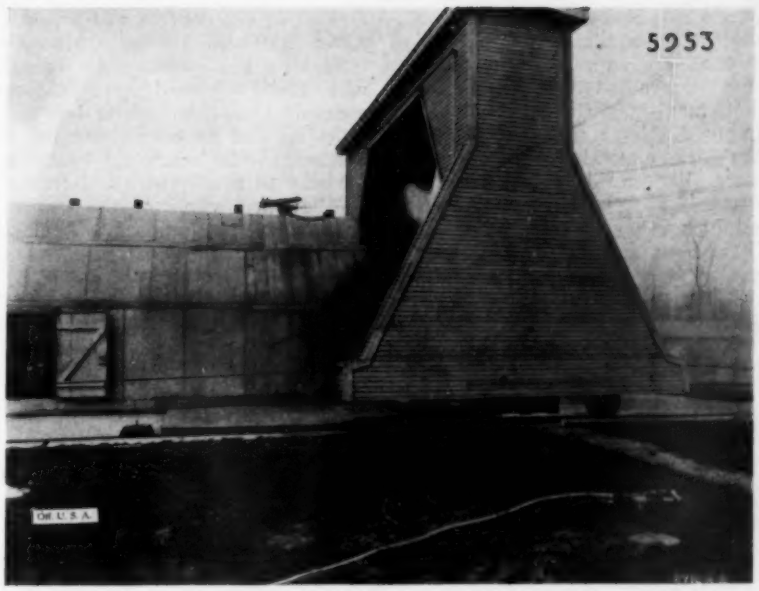


of balance between the blades produced surprising results.

Picture the utter bewilderment of the inexperienced Yankee pilot when his airplane suddenly vibrated from end to end like a giant massage machine. The unfortunate flyers, unable to see or think while the terrible shaking continued, felt there was but one thing to do—to stop the engine and land on whatever might be underneath. However, after making a safe landing, correction of the balance was easy; it was only necessary to whittle away the hard wood of the unbroken blade until a piece the size of the sliver torn from the opposite side had been removed. By that time the hands of the whittler would be well blistered, but the propeller would run quite smoothly enough to take the airplane to its destination.

After the Armistice, improvements in airplane design increased the top speed of service-type planes from a scant one hundred and twenty-five miles per hour to one hundred and fifty, and more. Wood propellers will not stand this pace. This fact was recently demonstrated when, due to a shortage of metal propellers, wooden substitutes were tried on certain low-powered but highly refined and fast training machines. Within a short period two of the wood propellers burst in flight.

To be strong, the blades should be thick if made of wood; but thick blades waste too much power when rotated at present-day speeds. At full power the tip of a modern propeller rotates through the air at the rate of twelve miles per minute. Seven hundred and twenty miles per hour! At such speeds raindrops bite away the wood like bullets. A change to metal had to be made. Steel proved much too heavy, but the newly-discovered alloy called duralumin made the change easy, yet brought new problems.



A test rig in action. Water is sprayed on the revolving propeller to simulate the effect of rain.

Note how the blade thrown from a broken propeller has crashed through the timber shield of the test rig.

Duralumin is just what the word means—hard aluminum. It was never heard of until, during the War, a German Zeppelin caught while bombing London draped its shattered and tangled length across two or three hills of the English countryside. Pieces sawed from the intricate metal structure were tested. They proved almost as strong as steel and nearly as light as the soft and untrustworthy pure aluminum which is so widely used. Chemists were called upon, and in a day or so they reported the exact composition of the new metal. It was an alloy consisting principally of aluminum, with copper and some other metals added in certain quantities. Every trace of substance which entered into it was known, and it could be easily duplicated, they were sure.

A batch of the alloy was melted, cast and rolled into sheets. It was worthless. For months experts worked day and night to solve this

puzzle and make the new and valuable alloy available to the Allies. It was an unprecedented mystery that confronted the chemists and metallurgists. They could absolutely duplicate the composition of the German metal, but their products were like a different substance, little, if any, better than pure aluminum; they were either soft, brittle, or apt to crumble after a period of use.

The final discovery captures the imagination. One can picture the weariness and disgust with which some metallurgists threw the perhaps ten-thousandth piece of metal on a bench, after testing and finding it as soft and worthless as its predecessors; and his amazed incredulity on returning a few hours later and finding it hard and strong. Doubtless he first suspected a practical joke, then retraced his work on that particular piece to see what unusual feature of its manufacture and heat-treatment was responsible for the unheard of phenomenon of a metal which of its own accord changed its temper and toughness while simply lying on a bench.

Cracks are made visible by etching with lye and nitric acid. This crack developed in consequence of fatigue failure.

The exact steps that led to the final perfection of the process of heat-treating duralumin are one of the mysteries of the war, but the process itself is no longer a secret. The aluminum alloy must be kept heated nearly to a dull red by immersion in a bath of melted potassium nitrate for a certain period, then be quenched in a cooling bath. The exact temperature of the potassium nitrate is very important, as a difference of ten degrees will seriously affect the finished metal. After the quenching the cooled metal is soft and easily formed into various shapes, but this must be done quickly. For an hour it retains its softness, while mechanics work feverishly to bend, twist and form it to the exact shape of the airplane part which is required. A short time after the hour is up it has become strong, hard and inflexible, like a different metal. It must be understood that heat is not applied during this process and the hard piece is not necessarily cooler or hotter than when it came soft from the quenching bath an hour before.

The process described is that employed in the manufacture of ribs, spars and other light parts of aircraft; but in making propellers, dies are used to shape the heavier metal to the exact shape desired, which would be almost impossible if it were worked by hand.

Shortly after the war an American inventor made the first duralumin propellers. The experts to whom he submitted his models were not much impressed, but consented to test them. Much to their surprise, these models behaved splendidly when subjected to the destructive whirling test, in which electric motors of many hundred horsepower rotated them faster and faster until the nerve-shattering roar could be heard for miles and the blades finally tore apart and bit great pieces out of the massive timbers that guarded the test-stand.

The "test-rig," as it is called, is a curious device which merits description. The electric motors which provide the power are ranged in line inside a windowless structure unlike any known type of edifice. It is long, low, rounded, of indeterminate color, and appears from a distance to be a huge mound of earth. The roof is of heavy iron; an iron door provides entrance, and the shaft for attachment of propellers projects through one end. Around this end is a shield of very heavy timbers, like a wide arch. Underneath this structure the earth has been excavated and replaced with massive masonry, which is tunneled with passages and rooms. One of the rooms is directly under the timber shield, and a narrow slot in the concrete ceiling gives a tiny view of the propeller rotating overhead. Through this slot observers with delicate instruments watch each propeller during test and measure the deflections of the blades as the speed of rotation is pushed higher and higher. A heavy iron shield is provided for closing the slot before the propeller actually bursts.

It was soon found that airplanes on which duralumin propellers were mounted were capable of greater speeds than had ever been attained before, and large numbers have now been placed in use, although they cost more than four hundred dollars each, whereas the old wooden type may be purchased for a hundred dollars. The extra expense is considered justified, as, other things being equal, the fastest plane will win an air battle or commercial supremacy, as the case may be. However, shortly after their use became general, trouble developed. The new propellers began to go to pieces in the air.

Centrifugal force causes each blade to pull outward with a force of more than twenty tons, when the engine is at full speed, although the blade itself only weighs about thirty pounds. This does not cause vibration because each blade pulls against the other, and in manufacture both blades are made exactly the same weight, tested by balancing the propeller on knife-edges so delicate that the weight of a fly would be indicated. Since any difference of weight between the two blades is multiplied more than a thousand times by centrifugal force, such slight lack of bal-

ance as results from the application of an extra coat of varnish to one blade will produce an unpleasant vibration. If one blade breaks off entirely the twenty-ton whirling pull of the other blade instantly shatters to pieces the light but sturdy engine to which it is attached.

The break of a blade may be due to flaws in the metal, since in forging the blades invisible seams are sometimes formed which extend through the propeller from end to end. These seams cannot be detected except by cutting off a piece of the metal, so the problem has now been solved by forging each propeller with a projecting portion on one end, which is cut off from the rough forging and tested. If any pores are found the forging is scrapped.

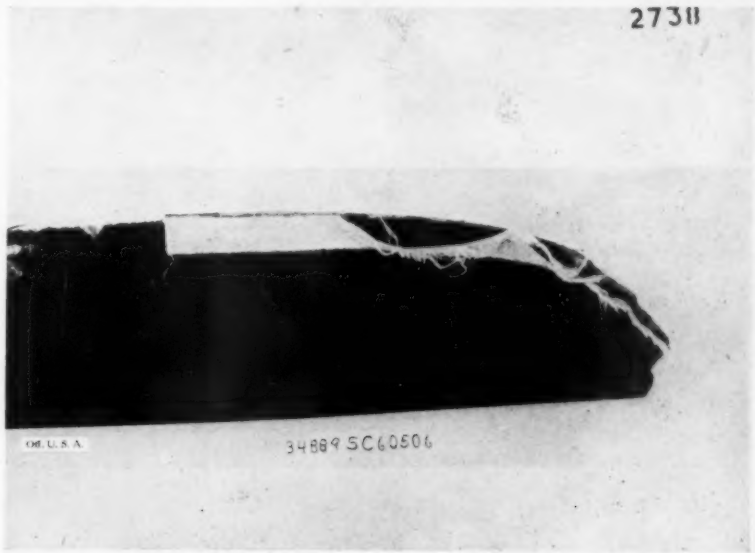
Most breakages have nevertheless not been due to flaws in the metal so much as to what is called "fatigue failure," which is explained as follows: All solid metal is composed of tiny interlaced crystals. In fatigue failure the crystals gradually separate at points where the metal is heavily stressed, tiny cracks slowly form and run together, and a break eventually follows. Vibration is the great cause of separation of the crystals, because of the almost imperceptible but continual bending of the metal which vibration induces; hence fatigue failure is frequently noticeable in such thin metal objects as automobile fenders, so often marked with spreading cracks. Wood is immune to fatigue failure, so propellers did not break from this cause until they were made of metal. Duralumin is particularly susceptible to fatigue failure, and the barely noticeable fluttering of the rotating blades is apt to cause tiny cracks after a few million revolutions, and in the course of additional millions of revolutions such cracks develop into actual breaks.

To catch fatigue failure before it becomes serious it is only necessary to examine the surface for cracks after a certain number of revolutions. For convenience the inspection is required every hundred hours. Since modern propellers revolve at speeds frequently exceeding two thousand revolutions per minute, one hundred hours of flying is equivalent to more than ten million revolutions of the propeller.

Unfortunately, the cracks are not distinguishable, even with a powerful magnifying glass, without special treatment of the surface. Hence in the examination the surface is etched or eaten away slightly with a solution of caustic soda, then brushed with nitric acid and rinsed with water; this causes any cracks which have formed to become distinctly visible.

The Army Air Corps recently sent orders to all its stations to etch and inspect all duralumin propellers immediately, and after every one hundred hours of flying thereafter. As if to prove the necessity for this measure, another accident occurred before it could be put into effect. An airplane was being tested at two hundred miles per hour when an explosion-like disintegration of propeller and engine occurred, as in previous cases. The pilot jumped, opening his parachute as he left the ship, which was only one hundred and fifty feet above the ground. Luck was with the pilot, as the parachute opened before he hit, and he landed safely, while the airplane, speeding without guidance, crashed at the very door of its hangar.

Such accidents will not occur in the Air Corps in future. The inspection by that branch of the service revealed cracks in many propellers, which were immediately condemned. With etching and inspection now required regularly, pilots wing their way confident that the efficient metal propeller will not run amuck and wreck the ship.



The tip of the wooden propeller and the linen cover have been eaten away by rain.

Extra Flying Money

THE response to Left Wing Low's invitation to pilots to send in accounts of their forced landings has been more than gratifying. In the first contest there were several stories that came so close to winning that we have asked the writers to submit them a second time. It was found too difficult to make a selection between the two leading stories, so the prize of $50.00 for the first contest was awarded to both pilots.

One of these stories, by Lieut. Henry H. Ogden, of the Round the World Flyers, appears in this issue of POPULAR AVIATION. The other, by Lieut. W. W. Conway, U. S. Marine Corps, will appear in the October issue.

POPULAR AVIATION will award a prize every month for the best Forced Landing story received. We know there are many splendid stories that have not appeared in print. For the present the prize will be a $100 wrist watch, which will be engraved with the winner's name. Simply mail the story, with photographs, if possible, to Left Wing Low, POPULAR AVIATION, 608 S. Dearborn Street, Chicago, Illinois. If your photographs are valuable and you wish them returned intact, merely indicate your desire and enclose postage.

Cloud-Signs on Aerial Highways

By M. Luckiesh

Fairweather Cumulus Clouds of the low cloud region are beautiful ever-changing signposts on aerial highways.

CLOUDS are the signposts on the highways of the winds. They make air-currents visible to us. Their forms tell the cloud-wise much in regard to the winds and weather in the regions inhabited by them. They are born of invisible water-vapor—often emerging before our eyes and disappearing again into that invisible world which is a mystery to most persons. Besides being extremely useful in signaling information to those who understand it, they add much beauty and variety of interest to all outdoor scenes. To the aerial traveler they are not only useful, interesting companions on skyland trails, but close-up views of them provide great thrills. It is easy to vest them with personalities—friendly, dainty, majestic, awesome, frowning, they are—and sometimes terrible.

The sky is indeed the countenance of Nature upon which an endless variety of moods and emotions is displayed. A clear, deep blue sky expresses the calm of peacefulness. No storm is in sight although the barometer may indicate that a change is brewing. When clouds are in the sky we may read the signs or we may respond to the mood—or both. They are clods, indeed, whose sensibilities are immune to the mastery of the sky. They are unobservant, indeed, careless, who do not learn to read the messages of the sky, if they fly or would fly. Certainly, an appreciation of the beauties and wonders and messages of cloudland will be awakened now that the age of flying has arrived.

The forms of clouds, their altitudes, their velocities, their groupings and their relation to each other and to the topography of the earth's surface cannot be fully appreciated without touring the cloudland trails. Views from the earth are deceptive to the uninitiated. This is a one-sided view complicated by perspective. However, if the habit of observation is combined with some study much can be gained from an earthly viewpoint. Then, when the opportunities come, one may finish his course in cloud-reading by flying among these signposts.

As one studies the clouds he soon notes that they may be divided into general classes and that certain characteristics are definitely related to altitude. He may begin by dividing cloudland into three regions—low, middle, and high. Knowing that clouds owe their forms to air-currents—winds, eddies, vertical convection, gentle drifting, or quiescence—he may begin to generalize regarding the relations of these with altitude. It is convenient and not without logic for the beginner to consider these three cloud-regions. Several general forms exist in these three regions and, of course, the actual individual forms are infinite in variety. It is this ever-changing form which is so fascinating, but, nothwithstanding this variety, the task of classifying cloud-forms is not difficult.

The high clouds—the cirrus and its combinations—are usually out of reach of the aerial traveler and at the present time some of them have not been reached by the highest flights on record. Sometimes these are so high that they would float far above the highest mountain in the world. They are in the region of speeding winds which whip them into streamers and a vast variety of wind-driven shapes. They float in thin, clean and frigid atmospheres and always consist of ice-crystals. Sometimes they are so vanishingly thin that they are barely visible. Sometimes a thin cirrus haze covers the whole sky. They are the last bright clouds in the sky after the sun sets for the observer at the earth's surface. These wispy curls in the glow of the sun which still shines on them fret the blue heavens with golden fire as the shadows of twilight are gathering at the earth's surface. The beauties of these upper clouds do not depend upon the colors of sunset although they are greatly enriched by them. Their delicate changing forms awaken f a n c i e s. Here the fairies find the filmy veils, delicate lace and richest embroidery. The halos around the sun and moon are the handiwork of these high thin veils. Cirrus clouds are found usually at altitudes between 30,000 and 40,000 feet. The high cloud-region may be considered to be that above 20,000 feet.

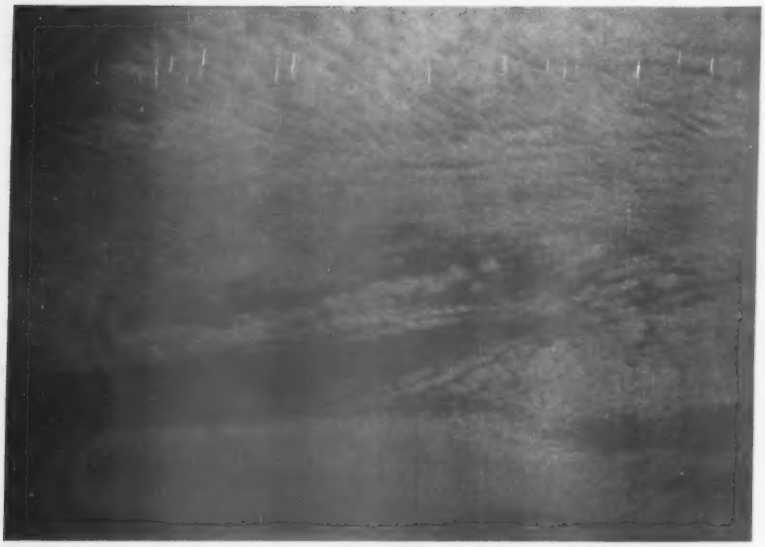
The clouds in the middle region would likely be characterized by the aerial traveler first as sociable, clannish or flocking. Cloud-flocks are found at other altitudes, but they are more predominant among the forms of the intermediate region than among the forms of other regions. They are generally thicker or somewhat more massive than the tenuous upper clouds and, therefore, display a variety of light and shade uncommon in the higher clouds. However, their individual forms vary from thin, delicate flakes, separated by patches of blue sky, to fleecy globular masses closely packed. They are often visible through openings in extensive layers of clouds of the low region. In this middle region there are plenty of other clouds, including the less varied stratus type which gives rise to the corona around the sun and moon, but the grouped clouds more effectively catch the interest and stir the fancies of the observer of clouds. The mackerel and billowed skies of the middle region are perhaps the only types of clouds, besides the cumulus of summer, that hold the attention of the casual observer sufficiently to enable him to describe them from memory. The clouds in this middle region are often seen to evaporate or to grow denser quite rapidly. These flocks or billowed oceans of clouds are among the superb sights along aerial highways. On rising to the level of such a billowy sea of clouds, one may note the minute details of air-currents made visible. Here one sees and feels the full glory of the kingdom of cloudland as he enteres the ballroom of the fairies. And to think that mankind can now enter this fairyland! Indeed, the wings of imagination have been replaced by the wings of reality.

The clouds of the low region which are likely to attract the average person are the heaped cumulus clouds. These appear to rest upon flat shadowed bases and to rear themselves in turbulent crests. The latter appear like cauliflower heads when the updraft which forms them is strong. When more gentle upward currents are responsible for them or the wind is strong at their altitude, their crests may appear like tumbled wool or even like fluffy wind-driven cotton. The difference in the wind velocities at their crests and at the bases is often noticeable. Under these conditions their crests strain forward and seemingly drag along the reluctant, lagging bases. These clouds average about a mile in altitude, although their crests often are found at 7,000 feet and their bases at 4,500 feet. Therefore, this low cloud-region may be considered to be that from the earth up to 10,000 feet. These cumulus clouds are perhaps the only ones generally observed. Overhead they appear like fleecy masses, grayed by shadows, not very interesting but lending variety to the blue sky. The fair-weather type sail gently along over the tranquil sea of blue, tinging a lazy mood with some signs of life. The more interesting cumulus clouds are those seen nearer the horizon. At this oblique angle much of the beautiful detail of their turbulent crests is visible. Their flat bases rest in the bluish haze of distance. When these are thunderheads they rear their heads high into the middle cloud-region.

At an altitude of more than a mile we glide over crests of cumulus clouds and in the distance huge thunderheads are in the making. High cirrus clouds overhead.

All these clouds and many others kindle the imagination. Each one is of interest and worthy of attention and thought, for it has a cause behind its existence. These are details which color the the monochrome of life of unobserving persons and convert it into a masterpiece of glorious splendor and untiring variety for observing persons. And they supply much to reflect upon for those with inquiring minds who would become cloud-wise. Let us now inquire into the origins of clouds and read their messages.

The great aerial ocean above the earth in which we now swim—under



The small globular masses arranged with some regularity are cirro-cumulus clouds at 20,000 feet.

the name of flying—extends upwards hundreds of miles. It rapidly decreases in pressure, density, and temperature with altitude. It is this variation which has much to do with the formation, existence, and meaning of clouds. The temperature of the air decreases with altitude at the rate of approximately 17° Farhrenheit per mile from an average temperature of about 52° at sea-level to about —67° (below zero) at an altitude of seven miles. The atmosphere above this appears to be at the same temperature, there being no further decrease in temperature at least up to 25 miles. Along with this decreasing temperature there is a rapidly decreasing atmospheric pressure or density. That is, the amount of air in a cubic foot grows less and less. For example, the pressure at an altitude of three miles is a little more than half that at sea-level and at seven miles is about one-fifth.

The atmosphere consists of many gases whose proportions, with the exception of water-vapor, are practically constant in the lower regions which interest us from a flying viewpoint. For altitudes up to seven miles nitrogen comprises about 78 per cent of the atmosphere and oxygen about 21 per cent. The remaining one per cent is made up of various gases and a slight amount of water-vapor. At sea-level water-vapor averages slightly more than one per cent of the volume of the atmosphere, but this diminishes to one-fifth this amount at an altitude of three miles and to less than one-hundredth of the average sea-level content at seven miles. The amount of water-vapor which air can hold depends largely upon the temperature and decreases as the temperature decreases. This accounts chiefly for the rapidly diminishing amount of water-vapor with altitude; for the fact that clouds are found only at the lower altitudes—below seven miles; also for the increasing tenuosity of clouds with increasing altitude.

Clouds are formed when the pressure and temperature of the atmosphere are such that all the water-vapor can no longer be retained. Atmosphere is said to be saturated when it contains all the water-vapor it can hold at its present temperature and pressure. The relative humidity is now 100 per cent. If it contains only 90 per cent as much as it can hold, the relative humidity is 90 per cent. It is now thirsty for the remaining 10 per cent of water. When air is perfectly dry it is 100 per cent thirsty—the relative humidity is zero.

In general, clouds are formed by the cooling of the atmosphere in some manner. This cooling is accomplished in several ways. On a quiet summer day we often see cumulus clouds—like great tufts of cotton or wool floating in the air. Their crests are generally at an altitude of nearly one mile. These do not float into view from some distant source beyond the horizon. They often are born before our eyes. The moisture-laden air is heated near the earth's surface. Becoming lighter by expansion due to the heating, it rises. This is termed a convection air-current. These currents continue upward normally to about one mile. On rising, the air expands owing to the decreasing pressure. It is well known that a gas cools on expanding and this principle is used in electric refrigeration. As the moisture-laden air rises it is cooled by expansion. If it cools to the point of saturation—that is, if it cools to the point that all its water-vapor cannot be retained—some of the water-

Approaching fair weather cumulus clouds at an altitude of one mile.

vapor condenses. This now is no longer an invisible gas, but consists of visible droplets of water. These droplets scatter light and we have a visible cloud. The optical phenomenon is similar to that of snow. Each particle of snow may be a clear crystal or sphere of ice; but the mass appears white. Crush a piece of clear ice into minute particles and we have a white mass, owing to the fact that light is now scattered in all directions by the myriad particles. Clouds above three miles consist of particles of ice—not drops of water. However, they appear quite the same yellowish white. Incidentally, sunlit clouds are pure white. They appear yellowish by contrast with the surrounding blue sky. Their shadows are bluish when these areas receive light from the blue sky.

A layer of moisture-laden air may be cooled by a layer of cold air sliding over or under it. Such a layer at night may cool of its own accord, just as a hot poker cools by radiating its heat into the colder regions about it. Under such conditions the layer of air may be cooled enough for some of the water-vapor to condense out. We then have a layer of cloud—fog at the earth's surface or a stratus cloud at higher altitudes. Consider the Newfoundland coast where fogs have caused so much difficulty to Atlantic flyers. The warm, moisture-laden air from the south following along the Gulf Stream meets the cold air coming down from the Arctic along the Newfoundland coast. The air is cooled to such an extent that it must give up some of its water-vapor. This water-vapor that is given up is condensed and we have fog—a cloud, usually of stratus type, lying at or near the surface of the earth. The same phenomena take place in the air and we have clouds.

High cirrus clouds usually show the effects of the high winds at those altitudes—from four to seven miles. These clouds often are born in a region of low barometer—a cyclonic area. Air flows—that is, wind blows—from a barometric high to a low. This is quite a natural thing, for a liquid will not remain piled up. Similarly, a fluid such as air seeks quiescence or equalization of pressure. The air flowing from all directions into a region of low barometer causes an upward flow in the center. This updraft may reach altitudes of several miles. The air has brought water-vapor with it. This condenses and cirrus clouds are formed. These travel on the high winds of the upper regions far out in advance of the moving barometric low. They herald the approach of stormy weather and tell the cloud-wise of what is still far beyond the horizon and many hours away.

Clouds float in the sky because the individual droplets of water or particles of ice are so minute that the viscosity of the air is effective in retarding their fall. They actually gradually settle in still air, and in general this settling is always intermingled with the effects of air-currents. It is not surprising that these minute particles float if one considers other examples. Fine dust will float in the air for a long time, but a clod of dirt will fall immediately.

In order that the reader may recognize clouds and gain something from their details, a brief paragraph is presented pertaining to the chief types. The stratus or layer formation is common to all clouds. When clouds are broken they are of the fractus type. Obviously, this term may be applied or added to several kinds of clouds.

The clouds of the high region consist chiefly of cirrus and cirro-stratus. Their altitudes vary from 16,000 to 45,000 feet, but average somewhere around 30,000 feet. The true cirrus clouds are seen more often in dry weather than in wet weather, but the cirro-stratus are predominantly wet-weather clouds.

The clouds of the middle region are chiefly cirro-cumulus, alto-cumulus, and alto-stratus. Cirro-cumulus clouds are small globular or fleecy masses or white flakes of cumulus clouds generally at altitudes of 20,000 to 25,000 feet—that is, in the lower cirrus region. They possess very slight shadows and are often arranged in more or less regular groups or lines. They are more common in dry than in wet weather. Their origin is usually due to local convection currents similar to those which give birth to the true cumulus clouds of the low region.

Alto-cumulus clouds are rather large globular masses, white or partially shaded, and often arranged in groups or rows similar to the cirro-cumulus. Their average altitude is about 13,000 feet, lower than the cirro-cumulus as the term "alto" implies. They originate in the calm summer weather when the humidity is low.

Billow cloud at 15,000 feet reveal the huge waves in the aerial ocean.

Alto-cumulus clouds are predominantly wet-weather clouds at an average altitude of about 13,000 feet. This layer cloud is sometimes formed by the forcing of a layer of air upward by converging winds in the storm area of a barometric low. It is also formed by a cold air-current coming into contact with it and cooling it. Sometimes it is formed by the cooling of the moist air arising from the evaporation of alto-cumulus clouds.

The dry-weather clouds of the low region—below 10,000 feet—are strato-cumulus and cumulus. The wet-weather clouds are nimbus, fracto-nimbus, stratus and fracto-stratus.

(*Continued on page* 93)

A Forced Landing

By Lieut. Henry H. Ogden

The "Boston" being refueled at Scapa Flow, Scotland, before the hop to Iceland.

Note: A forced landing was executed by Lieutenant Ogden and Lieutenant Wade 90 miles from Scotland and 110 miles from Faroe Islands on the trip of the first circumnavigation of the globe by air in 1924. Lack of oil pressure caused by broken vertical oil pump shaft brought them down.

AFTER an unsuccessful attempt to break through a bank of fog that was four or five thousand feet deep and thirty to forty miles wide between Kirkwall, Scotland, and Reikjavik, Iceland, we were forced to return to Scotland and start the next day for Iceland.

The weather was clear, making visibility unlimited and a slight tail wind was blowing twelve to fifteen miles per hour. Below us and as far as the eye could reach in any direction the ocean swells were heaving monotonously six to eight feet high and with no cross current winds to break the swells the whole ocean looked as if it might be rolling over logs placed a few hundred yards apart.

Everything was going along as smoothly and as beautifully as the ocean swells below, the ships flying along together over the awing vastness. All men watching sky and sea for wind indications, and the all important instrument board for possible trouble. And it was there that Wade and I both looked and sort of held our breaths, for with gradual sureness that is unmistakable the oil pressure gauge went back to the zero point and stayed there like a dead soldier.

No time to waste wondering; it was either a broken indicator or a broken oil line, and in about a minute the centigrade showed our motor getting hot. Our oil pump had failed. In a short time our motor would freeze, so there was nothing to do but to land then and there.

We nosed the plane toward the water and into the wind, striking the lower edge of one of those eight-foot swells, and both pontoons went out of sight and the lower left wing was practically covered with water. Neither of us expected the lower longeron to hold, but as she rode out on the other side both pontoons came up and there we were.

The other boys circled back, but they were as helpless as we were, and we motioned them on and saw them disappear over the horizon for Iceland.

The only damage done was the loosening of pontoon wires and breaking of two flying wires. But as if our presence in the middle of the ocean had disturbed the elements, the wind increased to about 20 miles an hour and almost 90 degrees from the way the swells were rolling, which meant that as soon as the ship would ride to the top of a swell the wind would catch her and swing her around 70 to 90 degrees and then down we would go on the other side. That seemingly quiet sea of a moment ago had entirely changed. A

drizzling rain that was almost sleet made it as cold as little billy-hell, and although we were entirely out of the course of any steamship line we had hopes and plenty of work to do to keep the ship right side up.

We had extra wires in the rear compartment, so Wade started working on them, while I worked on the pontoons. After working for thirty minutes under the wings of the rolling plane I came out, my head and stomach not knowing which felt the worse. I looked up at Wade, who had been all but standing on his head trying to get a bolt started under one of the wings, and he was as white as the proverbial ghost. "I believe," he said, "that I'll get in the cockpit and steer awhile." "Go ahead," I said, laughing, "and when I get sick I'll start steering too." That brought out that old Irish temper with that determination not to give in, and I believe that saved him from losing his dinner.

We worked steadily trying to keep the ship in position, the wind increased and the rain and sleet kept up the monotonous drizzle. We were soaking wet and the cold was all too evident. Water had to be emptied out of the pontoons constantly and we had to keep an eye on every part of the ship, crawling out on the wings and to the rear to arrange tools that were rolling around and to see that the cross wires in the fuselage were all right.

The time gradually slipped by, one, two, three and four hours, and the wind increased, making it necessary for one to be in the cockpit constantly to keep the ship on an even keel. We got maps out, endeavoring to ascertain our position, and we both had definite ideas as to where we would land if we drifted long enough. We made what preparations we could so that if worse came to worse the gas tanks could be pumped out and sealed for floats.

This forced landing took place about twelve noon and five hours later the clouds gradually lifted and far out on the horizon a smokestack appeared. It seemed almost unbelievable, and it would be impossible to express our emotions. We got in precarious positions and waved rags frantically to attract attention. It looked like a little old tug that might go straight home without looking one way or the other much, but the suspense was finally broken as she headed for us. It proved to be an old British whaling vessel, and we sort of laughed, for no telling how far away she had seen us, for specks in the ocean such as we presented were exactly what she was looking for. And that always reminded me of the old story, "What would you do if a battleship came sailing across the flying field?" No telling what the crew thought when they saw an airplane drifting along in the ocean. It had probably been months since they had put into a port, and it is possible that none of them had seen an airplane, to say nothing of knowing that there was a plan in progress to circle the entire globe in the air over land and sea.

As the whaling vessel moved in close, her captain shouted out, "What are you doing here?" It sort of stumped me for an answer so I turned to Wade and said, "You tell him," but the only reply he received from either of us was a smile—and that constituted all the communication we had with the whaling vessel.

Picking things out of the ocean proved right in our rescuers' line of business. They threw out a life line with a buoy on the end and circled the plane until it floated into us. I tied a rope around my waist and Wade grabbed the other end and I scrambled for the life line. All was going well and I was intensely interested in getting the line fastened to the plane when a big swell took up all the slack in the line between the vessel and the plane and I was almost thrown to (hell and gone) out in the sea but Wade gave the rope around my waist a powerful and anxious jerk just in time.

We finally got hooked up with the whaler and started for the steamship channel. We had difficulty keeping the ship upright as the swells were so high it was almost impossible to see the vessel's masts at times. It wasn't long then before one of our destroyers sent by the other boys who had landed safely in Reikjavik, Iceland, came along side. The tow rope was handed over to "Uncle Sam" and the whaling vessel's crew waved good-bye and was soon lost from sight. Our only thanks to them were sent by radio, the reception of which the Captain of the vessel acknowledged when pulling into a British port some weeks later.

Left Wing Low finally dodged responsibility for the choice of a prize in the first Forced Landing contest by awarding two checks for fifty dollars to the authors of two stories, one of which is here presented. Future issues of Popular Aviation will contain other Forced Landing stories.

A "Forced Landing" contest every month. A fine $100 wrist watch, engraved with the winner's name, for the best Forced Landing Story submitted each month. Mail to Left Wing Low, Popular Aviation, 608 S. Dearborn St., Chicago.

Lieut. Henry H. Ogden (then Staff Sergeant) displaying the French tri-color when the "Boston" was at Paris.

Current Comment

The National Air Tour

With the completion of the Reliability Tour and the annual awarding of the Edsel Ford Trophy, comes the realization that the history of the tour is in itself an epitome of the advance of aviation. As time goes on the length of the tour is extended. No records are sought save those that tend to convince the public of performance and safety. Entrants are flying under conditions that a few short years ago were thought to be insurmountable. Cities are being visited and treated to a spectacle that will, for many years, bring a thrill to nearly everyone. Aviation is being steadily advanced by this well conceived type of appeal to the public.

This Matter of Air Ports

We have a few disgruntled cities in this country. A few pastures have been leveled off and called air ports, local Chambers of Commerce have appointed aviation committees, and then rested on their oars. When tours of one sort or another have passed these communities by a howl has gone up from the zealous workers and loudly vocal assurance has been made that they have an air port and it should be used. Disgruntled contributors to the expense of preparing landing fields have been disappointed and somewhat soured on aviation.

The fact of the matter is that many of the fields are not suitable for use. The local flyers can use the fields, but no tour could expect to land and take off a number of ships of varied types on many of them without accident. There is a danger to the development of air-mindedness here. The requirements of a field are well known. The Department of Commerce has set forth certain quite definite standards for communities to follow in the planning of fields. As long as communities neglect these standards and spend money in an ill-advised way for inadequate flying fields, just so long will that community be without the benefits of aviation.

The same might have been said of good roads some years ago. The community that offered no facility for motor travel found itself more than isolated. It was handicapped definitely in an economic way. Something more than mere communication was involved. The whole matter ties up to modern life through the economics of transportation, the interchange of commodities, and the necessities of this day when time is such an essential of life.

The Carping Critic

Aviation is still news to the newspapers, and until it becomes a commonplace we can expect a natural distortion of aviation news in order to make "a good story." There is no question that a definite amount of harm is done by the slipshod accident reports, the wild stories, and the playing up of certain incidents. Newspapers, however, are clever, and exist only because they supply the public with what is wanted. They, as a whole, are about the cleverest salesmen we can find. Public support is a necessity and when the indications come in that the public is becoming critical of their product, axes fall, new editors appear and the product is changed to conform to new conditions.

When your newspaper makes some glaring error in its aviation news, or in its comment, call their attention to it in no uncertain terms. No publication likes to seem ridiculous in the eyes of its readers. When enough complaints have been made you can rest assured that aviation news will be scrutinized by an expert and errors will be at a minimum. You can do aviation a service by being the carping critic.

Help Wanted

It is a definite and ever-present problem of the operators of commercial aircraft to bring their services to the attention of the public. There is an unquestioned gap between supply and demand. In the words of the salesman's manual the "desire" has not been aroused. It must be admitted that at the present time there are many people who are not only uninterested but antagonistic to a personal use of the airplane. When general advertising media are used, such as newspapers, too large a proportion of non-prospects are reached to make it profitable to tell the story or sell the idea to the general public. The great mass of people are going through the process of education, and that takes time, but meanwhile there is that large number of people who are already interested who can be reached. They are the prospects of today, not tomorrow, and their numbers are large enough to make campaigns for their patronage profitable.

The solution of this difficulty of the operators is not far distant. It may be here today. It may lie in the mind of some advertising man who realizes both the possibilities and the limitations of aviation; it may be in the head of some transportation expert; some wise operator may have found the solution already and not know the gold mine at his feet.

Ex Cathedra

Some years ago, when the automobile and the motor truck were slowly coming into their own, and trackless transportation seemed about to be completely revised, many people predicted the extinc-

Current Comment

tion of the horse. Probably some of them went so far as to point out the waste in breeding horses and using them for any purpose except to lay a bet on them. When cavalry were introduced into military tactics it probably appeared to many, many, self-appointed experts that the death knell of the infantry had been sounded. Then the tank—and again infantry is doomed. Did the ever-increasing size of dreadnaughts and super-dreadnaughts doom the smaller ship? The telegraph did not supplant the letter post, nor the telephone eliminate the telegraph, nor the radio render both the others obsolete. All these facilities are used today, in ordinary life and in war, which is an intensified effort to survive. The reliance on but one facility may spell disaster. Possibly, in spite of the utterances of the oracles, the safe ground may be the middle ground, a compromise between utter conservatism and a radical departure from established methods. It may be that our best scheme of national defense will be an intelligent combination of land, sea and air forces, each planned for its best utilization and co-ordinated by men of vision who not only know the possibilities, but the limitations, of each branch of the services.

The Over-Seas Flights

In spite of the disasters, accidents and fiascoes attending some of the great distance flights attempted, certain facts stand out for the thoughtful person. Whatever he may think of the advisability or desirability of such performances; no matter if he considers aviation helped by the successes or hindered by the failures; or regards the pilots as brave pioneers or foolhardy daredevils; the thinking man will realize that these flights are becoming fairly common. The mere fact that they are planned shows a definite trend, and is in itself fair proof that it will not be long before such flights become more than a sporting event or an experiment. Surely and inexorably the time is coming when experience will show certain world routes to be practicable for the fastest means of travel yet known.

We cannot forget that once it was merely a "stunt" to cross this continent. Now it is an everyday business necessity.

Booming Business

As these lines are written the new air mail postage rates have been in effect a matter of forty-eight hours or so. Reports are coming in from many cities that already increases in mailings from fifty to over a hundred per cent in volume have occurred. The result is cold in statistical form, but it has been brought home to the writer in another way. Here on a suburban porch, a few miles from the airport of Chicago, one can realize the result already. Every evening the planes on three great routes pass this way. Ordinarily there are three at stated intervals, remarkably punctual as to time. Tonight there were five. One overhead with a roar, one off to the south, diverging, just a beating, pulsating sound in the sky, followed by another on the same course, this time the lights showing; to the north two more, a little later, both within sight and hearing. More planes in use, more pilots employed, more ground crews needed, more motors ordered, more traffic to bring the operators closer to realizing their plans for expansion, and more people receiving that little reminder of progress—a letter with the air mail stamp.

Vacationing De Luxe

Who has not had the fine edge of a vacation dulled by the tedium of the exasperating local train which railroads assign, through necessity, no doubt, to the branch lines that run to resort neighborhoods? Or, possibly the all-day or all-night boat trip that is required is not taken under the best of auspices. Business men whose families are more or less comfortably installed in summer cottages find it necessary to endure the soot and grime of a tiresome week-end trip in order to snatch a few hours of golf, bathing, fishing or tramping in the woods. The automobile has proved too popular, and the former short run by motor has become a painfully slow progression through the massed traffic that can be found near any of our larger cities and on any of the routes to popular resorts.

It will not be long before this condition will yield to the comfort, convenience and speed of the airplane. Resorts will be on the calling list of taxi lines, and the business man can close his desk Saturday morning, step in a plane and be at the lake, in the woods, or on the shore within a couple of hours. Five hour trips by car, or train, and ten hour journeys by boat will be compressed into two hours. The week-end play time of the business man can be doubled. It will widen the radius of the playgrounds about our larger cities and make accessible many beautiful districts that are waiting for the vacationist. Real estate developments on remote lakes and beaches become possibilities. And with this clean and airy transportation will come the tang of an experience that in a generation will be a commonplace—human flight.

Switzerland in the Air

Passing the Matterhorn in a Swiss plane you realize why many have perished in trying to reach its summit.

TRAVEL in Switzerland, regardless of the means employed, is at once able to offer a wonderful variety of aspects but it remains for the aeroplane to offer the most fascinating impression of all as it drones its way past snow capped peaks, over mountain lakes and rivers in linking city with city as a part of the vast European network of airlines. It is hardly necessary to plead the beauty of the Swiss Alps nor of her lakes and it suffices to say that the commercial air lines that carry passengers over Switzerland, or Schweiz, as the German speaking Swiss call it, serve to give a wonderful impression of the rugged mountainous character of the country. One can see more of the Alps in a few minutes of flying than the climber is able to see in weeks and if one wishes to satisfy that curiosity of discovering what it is like at the mountain tops among the snowy peaks it is much safer to find out when supported in the air by wings than by a dangling rope over a precipice, for Swiss commercial planes have been carrying passengers over the mountains and roaring their way through deep silent valleys disturbing the foreboding peace of nature ever since 1922 without a single fatal accident while not a few have lost their lives in climbing mountains.

For a nation that is at all times host to thousands of guests who come to enjoy her mountains, her lakes or her resorts, good travel facilities are necessary and the commercial aeroplane has taken its place among other means of travel in bringing people from all corners of Europe to this continental playground. So extensive is the amount of travelling in Switzerland that it is interesting to note that the business of accommodating their visitors has made the hotel and tourist business one of the principal industires of the country.

The Swiss are by nature a very progressive people and have been quick to see the possibilities and advantages of commercial air lines and accordingly have developed them to suit the requirements of their country. Switzerland, geographically, is of but 15,976 square miles in area and has a population of 3,880,320 and while not large, her position on the map of Europe is important. Air lines radiating in all directions from this little confederation have been extensively developed and each year sees an increase in their patronage. Much of the air traffic that extends beyond the boundaries of Switzerland is carried by foreign wings, principally German, but the Swiss lines themselves carry an appreciable amount of this traffic and have developed internal lines extensively to correspond with the international lines at her principal air ports. Their growth has been consistent with the development of the air lines in the border nations which have to some extent influenced them and while not as large nor as extensively exploited their patronage and popularity has been increasing steadily.

There are two principle operating companies in Switzerland whose planes are engaged in the daily transportation of passengers, mails and merchandise and who operate international lines in conjunction with several of the foreign lines in a "pool." These are the Ad Astra Aero of Zürich and the Balair Line of Basle. The operation of the lines exploited by them comes under the control of the *"office aérienne féd-*

eral" of the Swiss Federal Railways whose headquarters are at Berne where Major Arnold Isler is the Chief of the Air Service. The present development of commercial flying in Switzerland has largely been influenced by the development of air lines in Germany and at present most of the Swiss international air routes operate in a "pool" with those of the German Luft Hansa system. Both the Ad Astra and Balair systems' international lines make connections with German cities and the lines operated by the Luft Hansa. This has been of mutual advantage to the Swiss lines as well as the German lines using Swiss air ports. The Luft Hansa system, however, being a larger and more extensively developed organization predominates in this international traffic. One sees German planes in larger numbers than those of other foreign nations on Swiss fields due partially to the German co-operation with the Swiss and her geographical position which has brought about an excellent liaison of air lines between these two nations.

Briefly, the history of commercial flying in Switzerland began with the Ad Astra Aero organization who inaugurated a service from Geneva to Zürich and Nuremburg in 1922. According to records 122 passengers and 90 kilograms of mail were carried between Switzerland and Germany in that year and the service was in operation from May until September. In 1923 Ad Astra extended their Nuremburg service as far as Munich and the season was prolonged to October. In 1924 the

A German Roland Rohrbach on the Cointrin Field, Geneva, about to start on the Geneva-Zurich-Munich-Vienna line of the Luft Hansa Service.

Ad Astra service to Munich was further extended as far as Vienna in conjunction with the then existing service operated by the Trans Europa Union and now by the Luft Hansa system. During the same year the Belgian SABENA line *(Société Anonyme Belge d'Exploitation de la Navigation Aérienne)* inaugurated a service extending from Amsterdam to Basle and which is now operated by the K. L. M. *(Koninklijke Luchtvaart Maatschappij)* service of Holland. The Imperial Airways Ltd. of England also inaugurated their line between London-Paris-Basle and Zürich and the Lausanne-Geneva-Lyon service by the Aéro-Lausanne S. A. also began at this time. In 1925 the French C.I.D.N.A. line *(Compagnie Internationale de Navigation Aérienne)* called at Zürich between Strasburg and points in Central Europe while the Deutscher Aero Lloyd made connections between Hamburg and Swiss cities. Since then the Balair system which started with a service between Basle-Freiburg-Baden and Mannheim (now operated by Luft Hansa) has increased its services extensively and today the two Swiss air services are operating over the following routes:

Geneva-Zürich, Balair in conjunction with Luft Hansa.

Basle-Zürich-Munich, Ad Astra.

Zürich-Berlin, Ad Astra in conjunction with Luft Hansa.

Basle- Brussels- Rotterdam- Amsterdam, Balair in conjunction with K. L. M. of Holland.

Zürich-Stuttgart-Frankfürt, Ad Astra in conjunction with Luft Hansa.

Geneva-Lausanne, Balair.

Lausanne-Chaux de Fonds-Basle, Balair.

Basle-Zürich-St. Gallen, Balair.

Lausanne-Biel-Zürich, Ad Astra and Balair.

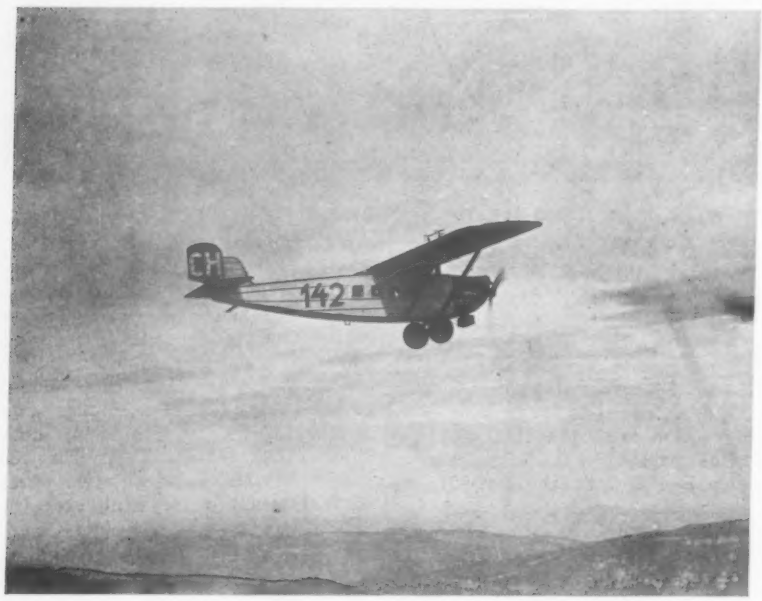
Berne-Basle by Balair (on request only).

Lucerne-Basle, by Balair (on request only).

The Balair line, which is officially know to Swiss who *parle francais* as the *Société Anonyme Bâloise pour la Navigation Aérienne* and as the *Basler Luftverkehrsgesellschaft* by Swiss who *spricht deutsch*, was founded in 1926 by its parent organization, the *Aviatik beider Basel*, an aerial society who owns the Birsfelden Field at Basle and who since

One can often get a close-up view of mountain peaks in flying over the commercial routes of Switzerland.

1920 have taken a big part in the development of commercial flying in Switzerland. This organization besides managing Birsfelden Flughafen, as they call it, operates the passenger line from Basle to Berne when the occasion demands, and operates planes from their field for air tours or joy rides over the Bernese Alps, those at Lucerne and other Alpine ranges within a short radius form the air port. They also have planes available for special charter and conduct an excellent aerial photographic service. Through the efforts of the *Aviatik beider Basel* Basle has become one of the principal air centers not only of Switzerland but of that part of Europe for a considerable radius.



A Dornier Merkur of the Ad Astra Service flying over the country near Zurich.

The growth of commercial flying in Switzerland is shown in the following tabulation of figures. These comprise the totals of the activities of the "pool" or combination of Swiss and foreign lines operating in Switzerland.

Year	*Distance, Kms.*	*Passengers*	*Post, Kgs.*	*Freight*
1922	95,300	122	90	.....
1923	155,300	1,158	515	.....
1924	531,600	3,231	21,328	6,066
1925	940,100	7,870	18,735	9,380
1926	684,000	6,112	31,515	15,103
1927	740,290	10,801	46,484	81,220

For air lines which daily operate over very mountainous country where atmospheric conditions are often bad and where high altitudes must frequently be reached, the Swiss planes have been able to operate with excellent regularity. In 1926 they were able to maintain a regularity of 93.4 per cent and attained a regularity of 97.6 per cent in 1927. During 1927 two of their lines, those operating between Basle and St. Gallen and between Basle and Zürich, maintained a regularity of 100 per cent. In establishing this record for regularity the former covered a distance of 13,780 kms., while the second line covered 20,800 kms. Since the inauguration of these air lines there has been no fatal accident, as has been stated, although their planes have been flying daily over the Alps, with but a single motor in most cases. During the winter months it is necessary to stop some of the air lines, owing to atmospheric conditions and there is a decrease in travel during the off season months.

At present the air lines of four nations call at Swiss air ports, bringing distant European cities to within a comparatively short time from the principal Swiss centers. The principal foreign lines that daily carry their passengers to the Confederation of Helvetia are as follows:

London, Paris, Basle, Zürich—Imperial Airways.

Lyon, Geneva—French Air Union.

Amsterdam, Rotterdam, Brussels, Basle—Balair and K. L. M.

Geneva, Zürich, Munich, Vienna, Budapest—Luft Hansa and Balair.

Geneva, Basle, Mannheim, Frankfürt—Luft Hansa.

Zürich, Berlin—Luft Hansa, Ad Astra.

Zürich, Stuttgart—Luft Hansa and Ad Astra.

Geneva, Marseilles, Barcelona, Madrid—Luft Hansa.

Zürich, Konstanz, Innsbruck, Salzburg, Vienna—OELAG.

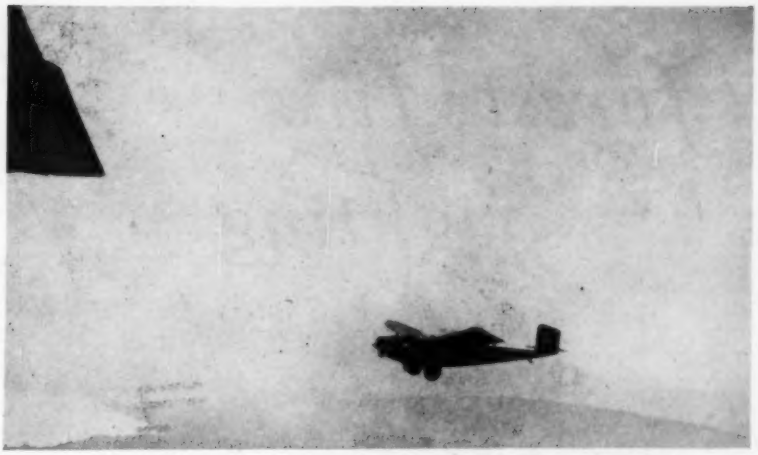
(Oesterreichische Luftverkehrs A. G. of Austria.)

The principal air fields in Switzerland are those at Geneva, Basle and Zürich, while others used by the commercial air lines are the Blécherette Field at Lausanne, Chaux-de-Fonds, the highest air field in Europe, those at Biel, Berne, St. Gallen and Lucerne. There are marine air ports at Geneva and Lausanne-Ouchy on the Lake of Geneva, Locarno on the Lake of Maggiore, Lugano on the lake of that name, Rorschach, Romanshorn, Kreuzlinger and Arbon on the Lake of Constance or Boden See as it is called there, Ermatingen on the Unter See, a small branch of the Boden See and Zürich on the lake of the same name. The Cointrin Field at Geneva is owned by the Canton of Geneva and is located at an altitude of 1,290 feet above sea level. At present an extensive building program is in progress which when completed will make it one of the best equipped in Switzerland. The Birsfelden Field in Basle is, as has been stated, the property of the *Aviatik beider Basel* and is one of the most important in Switzerland. Its location alone makes it of great importance, since geographically it is at the frontier of Germany, France and Switzerland on the banks of the Rhine and is used by Dutch, English and German planes as well as the Swiss. Its location is 795 feet above sea level. The air port is excellently equipped with all modern devices known to the most up to date air stations. Lengthwise the longest run is 1,000 metres, or approximately 3,000 feet for the take off, while the longest run in crossing the field, which ends at the Rhine River, is 540 metres, or about 1,620 feet. The

Dübendorf Field in Zürich is also an important one and is one of the principal air ports connecting with Eastern Europe and Germany. Besides being an important center for civil aviation, it is also important as a military field. It is situated at an altitude of 1,320 feet, about sea level, not far from the lake of Zürich and the city, and a short flight from this field takes one over the lake and the Bernese and Engadine Alps, which rise beyond its shores. It is owned by the Canton of Zürich and the field is annually the scene of an important international air meeting.

The planes used by the Swiss may be generalized by stating that most of the commercial planes are of German origin and those in the military service, French. Of the latter, the writer has noted several well known French military types bearing the white cross against the red background on their tails and wings, such as the Caudron and the Dewoitine. The Dewoitine planes, however, are built in a Swiss Dewoitine plant located at Thun. For commercial uses the Ad Astra Aero uses Junkers G-23 and F-13 planes as well as Dornier Merkur monoplanes. The Balair System makes use of Dornier Merkurs, Fokker-Grulich F-II monoplanes, Fokker III and Fokker VII-A planes. The Ad Astra Junkers planes as well as the Dornier planes used by both systems are furnished with German B. M. W. motors *(Baverische Moteren Werke)* in most cases with Siddeley Puma and motors of other various manufactures on the Fokkers according to their types. One often sees many foreign types of planes on the Swiss fields such as the big trimotor Rohrbach planes that carry passengers for the Luft Hansa from Geneva over the route to Zürich, Munich and Vienna, or the Handley Page planes of the Imperial Airways and French Blériot Spads that call at the Cointrin Field in Geneva.

There are several planes of interest that are manufactured in Switzerland such as the light Korsa T-1 monoplane which is driven by a 50 H. P. Anzani Motor. Another Swiss plane is the Lohner Flying boat which is built by the Alfred Comte Company at Horgen and used for touring purposes by the manufacturer on Swiss lakes. The Lohner is a small plane with a limited range of abilities but very suitable for use on these lakes where distances are not great. Several of these are being operated on the lakes of Zürich, Lucerne and the Thunersee. This same company also builds a small military pursuit plane of all metal construction and powered with a 420 H. P. Jupiter air cooled motor.



A German Roland Rohrbach approaches the shore of Lake Geneva, enroute to Zurich. Photo by the writer enroute to Basle.

A Balair Line Fokker banking over the Rhine before landing at the Birsfelden Field, Basle. Letters CH stand for Confederation de Helvetia, and identify Swiss planes.

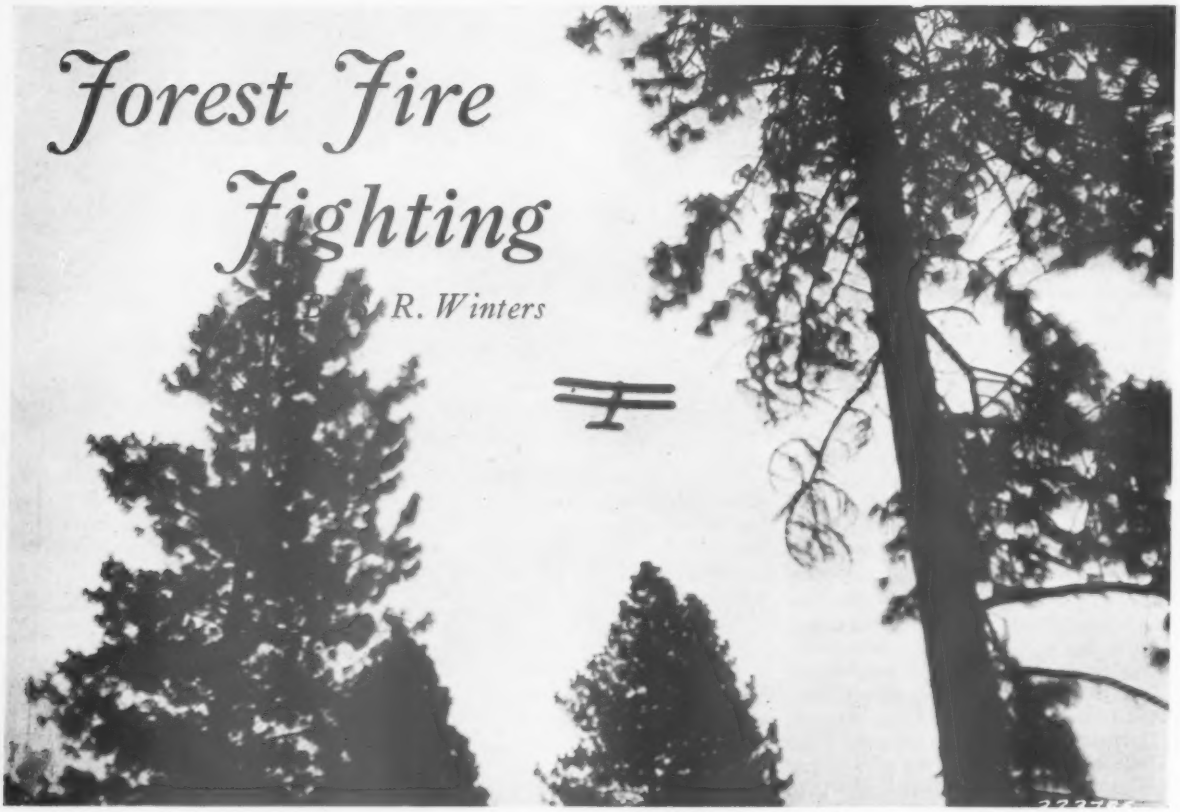
Among foreign planes which are built within the boundaries of the Confederation of Helvetia are the Dewoitine military planes which, as has been stated, are built in a Swiss plant located at Thun. The Dornier Company also have a plant located at Altenrhein on the Boden See under the name of the *Aktiengesellschaft für Dornier Flugzeuge.* This plant is situated on the Swiss side of the Lake of Constance or Boden See while the German Dornier plant as well as the Zeppelin Works are found on the opposite shores at Friedrichshafen. The German Dornier plant is known as the *Dornier Metallbauten G. M. B. H.* and is one of the great series of Dornier plants that are now located in Japan, Holland, Spain, Switzerland, and Italy. The Swiss plant is engaged in the construction of large flying boats of the "Wal" and "Super-Wal" types that will have a flying radii sufficient to carry them across the Atlantic when completed. A small flying boat for sport purposes known as the "Dornier Libelle" has been built there and equipped with a 55 H. P. Siemens air cooled motor.

Though flying in Switzerland offers wonderful sight seeing possibilities that should appeal to the tourist, the writer has noticed that most of the passengers between Germany and Switzerland seem to be business men who find the aeroplane as a great time saver. Recently in flying between Geneva and Basle a business man pointed out the fact that to take the train would mean a whole morning lost since the train

(*Continued on page 92*)

Forest Fire Fighting

By R. Winters



An Air patrol reconnoitering for forest fires in California.

CARRYING Uncle Sam's mails and fighting his forest fires with the same vehicle may appear so incongruous as to defy reasonable belief! Yet, by a mere coincidence, the same commercial airplane company that has accepted a contract to transport postal matter for the United States Post Office Department may be retained by the Forest Service of the United States Department of Agriculture to combat woodland conflagrations in the Far Western States.

In reality these two varied services are to be performed by one airplane company—the Western Air Express, now carrying the mails between Los Angeles and Salt Lake City, has just been awarded a contract by the Forest Service to patrol for forest fires in Southern California. A similar bid of the Pacific Coast Air Service Company has been accepted by the government, the latter airplane service to reconnoiter for woodland fires in Northern California. The Washington Aeronautical Corporation, with the Tacoma airport as a base, will cover the National Forests of Washington in search of forest fires.

Future contracts are to be awarded to commercial aircraft corporations to engage in forest-fire scouting operations in Oregon, Northern Idaho, and Western Montana. The National Forests in these five States embrace an aggregate area of approximately 55,000,000 acres. This marks the entrance of commercial flying into an entirely new field of service—as combatant of the "red enemy." For 8 years the Air Corps of the War Department and the Forest Service of the Department of Agriculture have maintained a co-operative arrangement whereby the airplane has served as an ally of the ranger's lookout station in detecting woodland conflagrations. This agreement between two government bureaus terminated on June 30, 1928, and hereafter commercial airplanes will comprise the fire patrol.

"Airplanes have a well-defined place in the Forest Service system of fighting forest fires," declares Colonel William B. Greeley, former chief of the Forest Service. "Although it is not believed that aviation can supplant the permanent lookout station," continues Colonel Greeley, who recently resigned from the government service, "forest officers generally are agreed that airplanes can be employed successfully as an adjunct of the ground forces.

"Airplanes have been found valuable in scouting above bad fires, in patrolling areas during periods when heavy smoke blankets obscure the vision of the ground lookouts and in spotting fires caused by lightning storms. They furnish a means of direct vertical view of any fire situation without the distortion of angular view or without interference from intervening ridges. The airplane is mobile and can go to the fire, circle above it gathering the information that is desired, and determining the exact status of the fire, its location, and character of material in which it is burning."

The Forest Service receives from Congress annually an appropriation of $50,000 for this air patrol, and while only nine airplanes will be employed for scouting during the 1928 fire season the area to be covered is measurably large—three whole states, portions of two others; the whole embracing an area of 55,000,000 acres. For the past two years, the co-operative arrangement be-

tween the War Department and the Department of Agriculture has evidenced an apathy responsible for the use of fewer planes and fewer flights —a condition probably occasioning the recent issuing of contracts to commercial companies! For instance, during the 1927 fire season only 247 flights were made, comprising an aggregate of 547 flying hours, and only 35 fires were spotted—compared with the use of 37 airplanes, a total of 3,996 flying hours, and the detection of 741 fires in 1920. In either instance, these figures, do not correctly appraise the value of the flying machine as a combatant of the "red enemy" nor do they suggest the gradual unfolding of new ideas which the air patrol is capable of applying to the reduction of our enormous toll by forest fires.

The use of airplanes after lightning storms to search out smouldering fires which might be hidden from ground lookout stations by intervening ridges is a potentiality to which flying machines are now being subjected in experiments by the Forest Service. When clouds of smoke obscure the vision of the ranger from his stationary lookout station, usually located on a mountain top, the mobile airplane can approach at close range the scene of the fire a-borning! When a National Forest is being ravaged by a great conflagration the government officer in charge of the fire-fighting crew can, taking along a map of the area, go up in an airplane and gather information which will at least enable him to check the spread of the conflagration if not suppress it immediately. The airplane, too, offers possibilities as a direct fire-fighting agent—spraying chemicals onto a conflagration! This opportunity invites some chemical company to prepare an effective chemical. For, as an official of the Forest Service told this writer, the present chemicals are ineffectual—about as effective as an equal amount of water—and the failure of the method is not a weakness of the airplane!

Airplane on forest fire patrol service, Cleveland National Forest, California.

"Airplanes are in use in California, Oregon, Washington, Idaho, and Montana, chiefly to reconnoiter large fires," points out the Forest Service. "Where there are no ground lookout men," continues Uncle Sam's fire-fighting bureau, "they are valuable also to learn whether any fires are burning and, if so, where located and how large. The difficulty of protecting National Forests from fire is such that every promising method must be tried. The Forest Service plans to continue the experimental use of aircraft and thus determine definitely their place and limitations."

Airplane view of forest fire, Santa Barbara National Forest, California. See the face in the smoke.

This government bureau frankly admits that the airplane cannot, as a fire detection agency, successfully compete with or displace the age-old lookout station—the attendants of the latter being on duty 24 hours each day, compared to one or two patrols daily by the air service.

The Forest Service, too, admits that the antiquated flying machines used by the Air Corps of the War Department for patrol work during recent years have handicapped the progress of the airplane as a fire fighter. This obstacle will be sidestepped by the commercial concerns, since the latter will employ modern machines. For example, one of the companies to which the Forest Service has awarded fire-patrol contracts will use the Douglass airplane and another the so-called "Buhl Air Sedan." Five bases will be used during the 1928 fire season—Mather Field and Grith Park in California; Eugene in Oregon; and Seattle and Spokane, in Washington. Commercial airplane companies scouting over the woodlands of Oregon and Washington will furnish the necessary flying equipment for pilot and observer; whereas, in other instances the Forest Service will purchase parachutes and other units required for safety and also buy conventional uniforms.

Curiously enough, the forest-fire air patrol of 1928 will not be equipped with radio transmitting and receiving apparatus. During the early application of aircraft as an agency in detecting fires, the United States army experimentally equipped

The patrol for the Klamath National Forest, California.

the scouting planes with radio equipment but with forest rangers here, there, and everywhere radio communications were unable to reach them when summoning help for suppressing a fire. Now, messages are dropped from scouting planes on the fire lines or on the ground and are picked up by forest rangers as they make frequent "beats" on the National Forest trails. Similarly, a novel use of the airplane on the government domain is the transportation of fire-fighting tools and food supplies, dropping them at strategic points for the benefit of the fire-fighting crew.

"This," we are told by the Forest Service, "is a highly satisfactory use of the planes, namely, for transporting materials and food to crews working on actual fire lines." This and similar innovations are likely to make of the airplane something other than a patrol. In fact, an official of the Forest Service states: "Experiences of former years led to some radical changes in the methods of using the planes. Instead of regular patrol flights, the planes were held in readiness to make special flights whenever called upon. Observers were recruited largely from the Forest Service personnel, as an accurate knowledge of the territory covered is essential. Ordinarily, forest officers would call for airplane service either to observe a going fire or for detection of fires immediately following a lightning storm. In one instance regular patrols were made over an area infested with incendiaries, with good results." That is to say, this patrol service had a deterrent or moral effect on careless campers and reckless visitors to the National Forests, who are responsible for a sizable share of the forest fires.

Paralleling the excellent record of the Air-Mail Service of the United States Post Office Department, the eight years' of air patrol for forest fires is unspotted with tragedies of major crashes—certainly, no disaster has occurred within the last four or five years. This record, too, is all the more surprising in view of the rough, mountainous areas over which the airplanes flew. That the commercial companies will not mar this perfect record is, as Shakespeare would say, to be devoutly wished, by the Forest Service. And, again we pause to marvel at the ever-widening uses of the flying machine—now flying for Uncle Sam, at so much per hour, over 55,000,000 acres of woodlands as a reconnoitering agency for lessening the enormous toll taken yearly by fire. Many lumber companies, particularly in Canada, have found the use of the plane profitable in cruising and for fire patrol work.

Marker for plane patrol on top of Saddle Mountain, Oregon.

The policy of the government in turning over the patrol work to private interests is not an evidence of lack of interest but is the logical following out of the plan to encourage commercial operators. Various departments of the government are co-operating with the Department of Commerce in this respect and as fast as facilities are available contracts will be let to privately operated companies for work now done by planes borrowed from one of the national services.

Fire in the Tahoe National Forest, California, as the patrol sees it.

Avigation

Short Method for Line of Position

By Lt. Cdr. P. V. H. Weems, U. S. N.

THE following lines of position were worked and laid down to demonstrate the accurate results, together with the speed and facility with which lines of position may be worked under the most favorable condition, i.e., with the latest equipment using a special form and with a steady platform. By arranging the work in columns, the necessity for frequent turning of pages is avoided, and the form written once at the left margin suffices for a double page, or if the pages succeeding the page carrying the form are cut away about half an inch, then one form suffices for the entire work book.

The equipment used was as follows:

1. Bureau of Standards Navy bubble sextant.
2. Aero-Chronometer, or second setting watch, set to Greenwich apparent time to the exact second.
3. Line of Position Book.
4. Chart, dividers, and pencil.

This method has been developed especially for the airman. While all the short cuts may be used at sea, it might be desirable to keep the watch set to Greenwich civil instead of apparent time. Since the noon equation of time is used for apparent time, and since this may change as much as about a second an hour, an error of about four seconds, or one minute of longitude, may result with lines worked at 0800 or 1600.

The second setting watch is set to the exact second by the simple expedient of a movable second dial.

Aviators should not be misled into thinking the accuracy here obtained may be expected in the air. As a matter of fact, an average error of less than ten miles in a plane is good work, and in bumpy air this is not easily obtainable.

SAMPLE SIGHTS, WORKED BY THE LINE OF POSITION BOOK

USING SECOND SETTING WATCH SET TO GET FOR THE GCT OF LOCAL NOON, AND SHOWING SIMPLIFIED FORM FOR NAVIGATION

NOTE: THE WATCH TIME FOR NOON IS THE GHA BUT 12HRS AND 00T ARE ADDED TO GET THE GCT FOR PICKING OUT DEC. IF SIGHTS ARE NOT TAKEN IN CLOSE SUCCESSION, THE SAME WORK AS FOR NO. 1 SIGHT WILL BE REQUIRED. IN THIS CASE THE COLUMN FOR TERMS LHA TO H_o ARE THE SAME FOR EACH SIGHT AND NEED NOT BE REPEATED

AVERAGE ERROR OF 6 SIGHTS 1.4 MILES

ERROR FOR 6 SIGHTS AVERAGED .4 -

TOTAL TIME FOR 6 SIGHTS 14 MIN

AVERAGE TIME PER SIGHT 2 MIN 20 SEC

USED BUREAU OF STANDARDS SEXTANT + USN HAMILTON CHRONOMETER WATCH AS ALTERED BY J. JESSOP + SONS

TRUE POSITION OF OBSERVER L 32°-42.0' N, L 117°-11.0' W

	1	2	3	4	5	6
GHA (time)	7-03-00	4-26	5-00	5-37	6-18	6-45
GHA (deg)	105-45	106-065	106-15	106-243	106-343	106-413
Longitude	116-45	117-065				
LHA	11°E	11	11	11	11	11
LAT (assd)	33°N					
K	33-29.2N					
DEC	16-02.2 S					
K ~ d	49-31.4					
A	563					
B	18760					
Log H_c	19323					
H_c	39-51					
H_o	40-02	40-12	40-09	40-13	40-16	40-15
a	11T	21T	18T	22T	24T	24T
Z	S23½E					
ERROR	2A	36T	1A	1T	1T	0
	1	2	3	4	5	6

Short Method for Line of Position. Data at left may be arranged at bottom.

The advantages of the Line of Position Book are:

(a) No interpolation.

(b) Compactness.

(c) It affords an easy short solution for the computed altitude and azimuth.

Speaking from the aviator's standpoint, the one difficulty in working lines of position in the air is the difficulty of observing the altitude with sufficient accuracy when a natural horizon is not available. Once we have an accurate means of measuring the altitude, the use of heavenly bodies for determining position may be expected to come into popular use.

In the following problems the Greenwich apparent time, or twelve hours, plus the Greenwich hour angle (GHA) is used for picking out the declination:

In this particular case, all six observations were made in less than four minutes, and for this reason, the same local hour angle and latitude are used for each line, making one solution by the tables suffice for all six lines. The average error of six lines of position is 1.4 miles, the algebraic average is .4 mile, that is, if the six observations were arranged, one line of position with less than a mile error should result. The time for working the six lines and laying them down on the chart was 14 minutes, or an average of 1 min. 20 sec. for each line.

To give an idea of what may be done with sun lines of position in the air, the lines worked in the Navy

Chart for Sun Lines of Position.

SAN DIEGO TO SAN PEDRO via MAIL PLANE—28 NOV. 1927

(COPIED FROM WORK BOOK)

FORM	1023 SUN	1033 SUN	1040 SUN	1052 SUN	1100 SUN	1104 SUN	1114 SUN	1129 SUN	1132 SUN
C	6-23-48	6-33-45	6-41-18	6-52-30	7-00-30	7-04-41	7-14-58	7-29-30	7-32-30
Corr (see)	+12-37	+12-37	+12-37	+12-37	+12-37	+12-37	+12-37	+12-37	+12-37
GAT	18-36-25	18-46-22	18-53-55	19-05-07	19-13-07	19-19-18	19-27-35	19-42-07	19-34-07
GHA1	99°-06.3	101-35.5	103-28.5	106-16.5	108-16.5	109-49.5	111-53.5	115-31.5	113-33.5
Long	117-06.3	117-35.5	117-28.5	117-16.5	117-16.5	117-49.5	117-53.5	117-31.5	117-33.5
LHA	18°E	16°E	14°E	11°E	9°E	8°E	6°E	2°E	4°E
LAT	33°N	33°N	33°N	33°N	33°E	33°N	33°N	33°N	33°N
DEC	21-14.5	21-14.5	21-14.5	21-14.5	21-14.5	21-14.5	21-14.5	21-14.5	21-14.5
K	34-19.6N	34-02.5	33-47.8N	33-31.0N	33-15.4N	33-08.6N	33-01.0N	33-03.5N
K ~ d	55-33.7	55-16.7	55-02.1	54-43	54-34	54-30	54-23	54-16	54-18
A	1510	1193	913	563	371	298	168	19	74
B	24761	24449	24177	23836	23676	23605	23481	23358	23393
Log H_c	26271	25642	25090	24399	24053	23903	23649	23377	23467
H_c	33-06	33-39	34-08	34-46	35-05	35-13	35-35	35-43	35-38
H_o	33-20	33-48	34-11	34-39	34-31	34-43	34-47	35-13	35-07
a	14T	9T	3T	7A	34T	30A	41A	30A	31A
Z	S23°E	S18°E	S15°E	S13°E	S11°E	S9°E	S7°E	S2°E	S5°E
	1	2	3	4	5	6	7	4	8

AVERAGE ERROR: 6.6 MILES EQUIPMENT: Bureau Sextant, Aero Watch, Line of Position Book, Chart, Dividers, Pencil

Sun lines of position worked in air

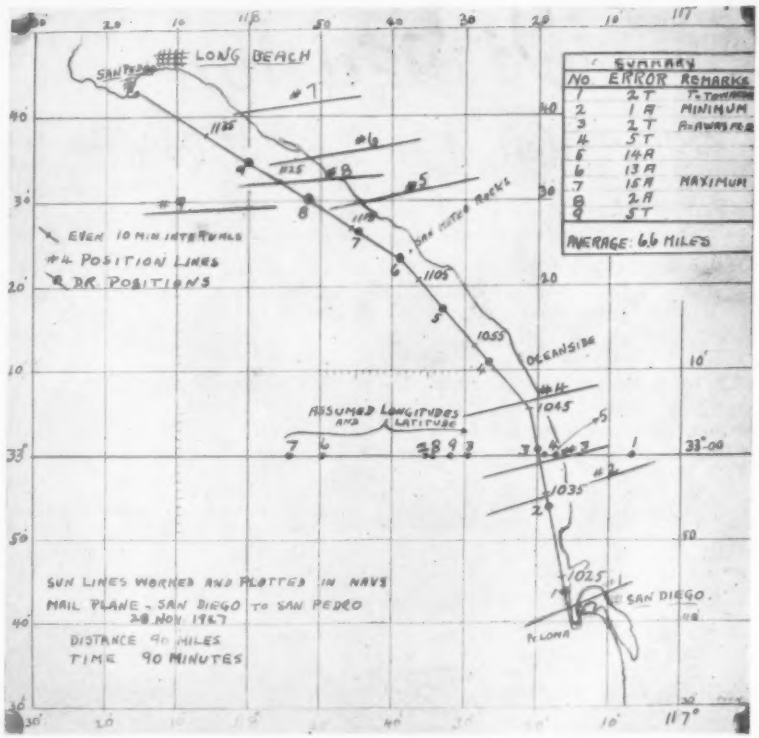
plane between San Diego and San Pedro, California, 28 Nov., 1927, are shown in detail. A distance of ninety miles was covered in ninety minutes, during which time nine sun lines of position were worked. Single shots with the Bureau of Standard's sextant were used in all except the ninth line, when five altitude and five lines were averaged. No sights were thrown out, and this work represents the first line of position the observer had worked in the air.

By having the solution arranged in columns with the form at left as shown, one double page sufficed for all nine lines thereby avoiding the inconvenience of turning the page. Elastic bands kept the leaves of the 8 x 10½ inch note book from blowing about. Observations were taken from three points: the first shot being taken by leaning out the starboard port into the wind stream; some were taken through the after cock-pit, and others from the pilot's cock-pit forward. Air conditions were good.

Had the aero-chronometer, or second setting watch been available at the time, the Greenwich hour angle (G.H.A.) in time could have been read directly from the watch. As it was, the chronometer correction was combined with the middle equation of time, making only one step between the chronometer reading and the G.A.T.

No satisfactory explanation can be given to account for the errors of 14, 13 and 15 miles for positions 5, 6, and 7. More than likely this was due to errors of observation though it is possible that lost motion had something to do with it. It will be noted that the Line of Position Book was used without interpolation, and further, that the azimuths range from 23° to 2°, the latter being practically a meridian altitude, demonstrating the fact that the usual meridian altitude or ex-meridian sight is no longer necessary. Had the 1129 sight been taken exactly at local apparent noon, no logarithms would have been written down, as A in that case would be zero, and with Kd in table B, the computed altitude could be picked out directly, and the line laid down as in the other sights, the resulting line being an altitude line.

(This is the second article by Lieutenant Commander Weems, on certain practical aspects of avigation. Others will appear in later issues of POPULAR AVIATION.)



Books on Aviation

JUST in passing, the recently published *Atlas of the European Air Lines* has been received and a hasty glance through it is convincing enough proof of the aviation activities of the Continent. Nearly three hundred atlas size pages are devoted to photographs and minute descriptions of the airports in the various countries. All the necessary information is listed, weather conditions, lighting, accommodations, service, and the like. Many airports are shown in photographs. This section is followed by a series of maps covering all the commercial routes and the surrounding territory. Plan views of the principal cities with airport locations indicated are printed along the sides and on the back of each set of maps, which are in three colors and show all the railroads, rivers, cities and towns. Regular routes are all indicated and numbered, and tables are supplied showing rates between every city reached by the lines. Could such information be compiled in this country an impressive volume such as this might be possible, but for the present at least it is impossible as any such work would be out of date long before it could be published. In Europe it is the Bradstreet of the air.

Engineering Aerodynamics by Lieutenant Diehl, U. S. N. (Ronald—$7.00) presents to both the aeronautical engineer and student a mass of theoretical and practical design data, simplified and arranged in a comprehensive form for convenient reference and use. On glancing through the text, I find material on wing sections, with theories advanced as to the best methods for satisfactory design, correct means by which to observe data on airplane model tests, charts on performance and parasite drag data, special field problems, and much other information which certainly would be of great value to either the "budding airplane designer" or the man already in the field, but wanting to "keep step" with all latest information. As this book is new, and much of the material has never before been available, the latter will find it especially worth while.

The chapter on range and endurance of aircraft is interesting, for his charts are easily read and understandable. He explains the effect of head and side winds on the efficient operation of airplanes, and shows the effect the same wind would have on bombing range.

(*Continued on page* 90)

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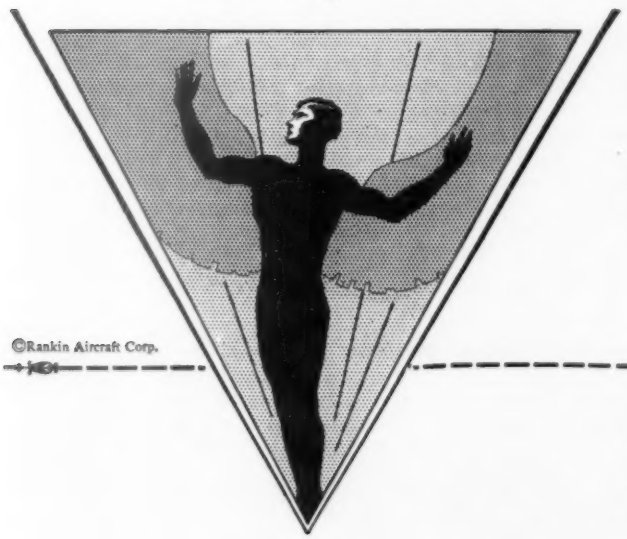

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John P. Wood, the winner of the 1928 National Air Tour.

The National Air Tour

THE National Air Tour is one of aviation's greatest events, and takes place once in a year. It is a test of flying skill and the reliability of planes against all hazards. Manufacturers find it a testing ground for the material they have offered, and pilots a final test of the skill which they, through experience, have accumulated.

The 1928 tour started from the Ford Airport at Detroit, Mich., on the morning of June 30, and the staccato roar of many planes was heard when Edsel Ford dropped the starting flag for the first plane, a Monocoupe piloted by Mrs. Phoebe Omlie. The remaining ships took off one minute apart and before thirty minutes had elapsed the lane between Detroit and Indianapolis, the first leg of the tour, was literally filled with craft trying to better one another for the ultimate prize.

To promote this event, check all pilots at the various cities, and follow it through in a systematic order from start to finish was a tremendous undertaking and Mr. Ray Cooper, manager of the tour, together with his staff are to be con-

(*Continued on page 78*)

Order of Finish and Scoring in National Air Tour

Place	*Make of Ship*	*Points*	*Prizes*	*Engine Used*	*Entered by*	*Owned by*	*Pilot*
1	Waco	27,013.4	$2,500.00	Wright J-5	Advance Aircraft Co.	Advance Aircraft Co.	John P. Wood
2	Ford Trimotored	24,390.8	2,000.00	Wright J-5	Stout Metal Airplane Co.	The Texas Co.	Frank M. Hawks
3	Stinson-Detroiter Jr.	23,865	1,750.00	Warner	Stinson Aircraft Corp.	Otto Leisey	Randolph Page
4	Waco	22,127.1	1,500.00	Wright J-5	Advance Aircraft Co.	Advance Aircraft Co.	Charles W. Meyers
5	Stinson-Detroiter	21,243.0	1,250.00	Wright J-5 G1B	Stinson Aircraft Corp.	E. A. McIntyre	Edward A. Stinson
6	Stinson-Detroiter Jr.	19,871.3	1,000.00	Warner	Stinson Aircraft Corp.	D. W. Moore	*Bruce Braun
7	Ryan Brougham	19,728.9	750.00	Wright J-5	B. F. Mahoney Aircraft Co.	Texas Pacific Coal & Oil Co.	Al Henley
8	Bellanca	19,445.3	550.00	Wright J-5 CA	Wayco Air Service, Inc.	Wayco Air Service, Inc.	William S. Brock
9	Ryan Brougham	18,389.3	400.00	Wright J-5	B. F. Mahoney Aircraft Co.	Mutual Aircraft Corp.	Vance Breese
10	Buhl "Airsedan"	17,948.1	300.00	Wright J-5	Buhl Aircraft Co.	Buhl Aircraft Co.	Louis G. Meister
11	Lockheed	17,946	.....	Wright J-5 C	Lockheed Aircraft Co.	Lockheed Aircraft Co.	Robert Cantwell
12	Fairchild	15,974.5	.....	Wright J-5	Fairchild Airplane Mfg. Co.	Fairchild Airplane Mfg. Co.	Richard W. Pears
13	Travel Air	15,780	.....	Fairchild Caminez	Travel Air Mfg. Co.	.....	J. N. Kelly
14	Bellanca	15,080.8	.....	Wright J-5 CA	Wayco Air Service, Inc.	Wayco Air Service, Inc.	George Haldeman
15	Swallow	13,604.8	.....	Wright J-5 AB	Swallow Airplane Co.	Swallow Airplane Co.	R. Aavang
16	Buhl "Airster"	13,522	.....	Wright J-5	Buhl Aircraft Co.	Reid, Murdoch & Co.	Algen Graham
17	Stearman	12,700.8	.....	Wright J-5 AB	Stearman Aircraft Co.	Stearman Aircraft Co.	David P. Levy
18	Eaglerock	11,477.7	.....	Hispano-Suiza "E"	Alexander Aircraft Co.	Alexander Aircraft Co.	C. P. Clevenger
19	Monocoupe	8,370.6	.....	Velie M-5	.....	.....	Jack Atkinson
20	Ryan Brougham	8,196.4	.....	Wright J-5-C	B. F. Mahoney Aircraft Co.	Cleveland Pneu. Aerol Co.	E. W. Cleveland
21	Waco	7,850.6	.....	.....	.....	.....	M. G. Beard
22	Travel Air	6,715.4	.....	Siemens-Halske	Travel Air Mfg. Co.	George B. Peck	George B. Peck
23	Curtiss "Robin"	.....	.....	Curtiss OX-5	Curtiss-Robertson Co.	Curtiss-Robertson Co.	Dan R. Robertson
24	Monocoupe	5,523.0	.....	Velie M-5	Mono-Aircraft, Inc.	Mono-Aircraft, Inc.	Phoebe Fairgrave Omlie
	Eaglerock	5,949.9	.....	Menasco-Salmson	Alexander Aircraft Co.	Alexander Aircraft Co	Benny Howard
	Challenger	.....	.....	Fairchild Caminez	Kreider-Reisner Co.	Kreider-Reisner Co.	A. H. Kreider
	Mohawk	.....	.....	Warner	Mohawk Aircraft Co.	Mohawk Aircraft Co.	Dr. Jos. A. Nowicki
	Fleetwing	.....	.....	Wright J-5 (2)	C. C. Runkell	C. C. Runkell	C. C. Runkell

*Schoenhair finished for him.

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Old Number One Comes Home to Stay

OLD Travel Air No. 1 has had an interesting career. Bought in 1924 by O. E. Scott, of St. Louis, its first trip was a call on Henry Ford. It was the first new production job Lindbergh ever flew. It has felt the hands of the great and near great at its controls. In it many prominent bankers, financiers and business men have flown. In it Nussinger and Ruth Elder have made more than one trip. And after having been all over the country on various missions it has at last come home to rest with the honor and sentiment that is its due.

This old ship has had 1750 hours in the air with no replacement. It is still airworthy—still trim. It doesn't look out of place among the latest Travel Air ships staked out along the line at the factory.

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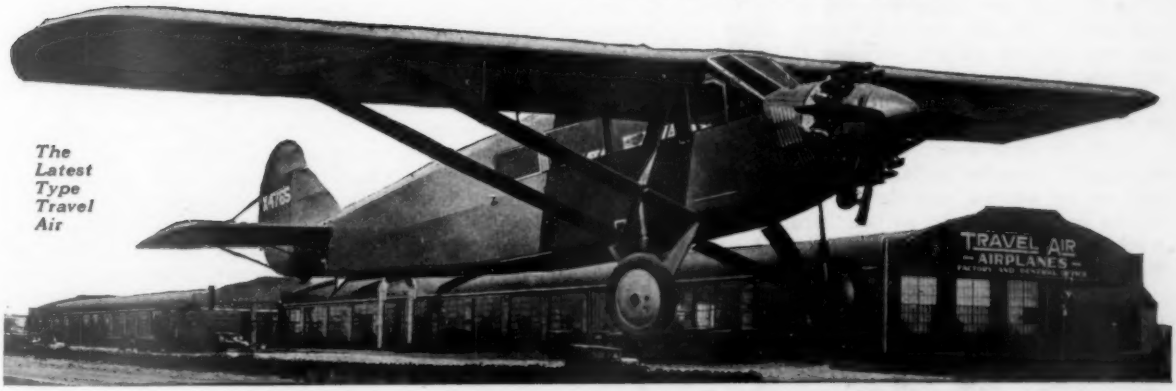
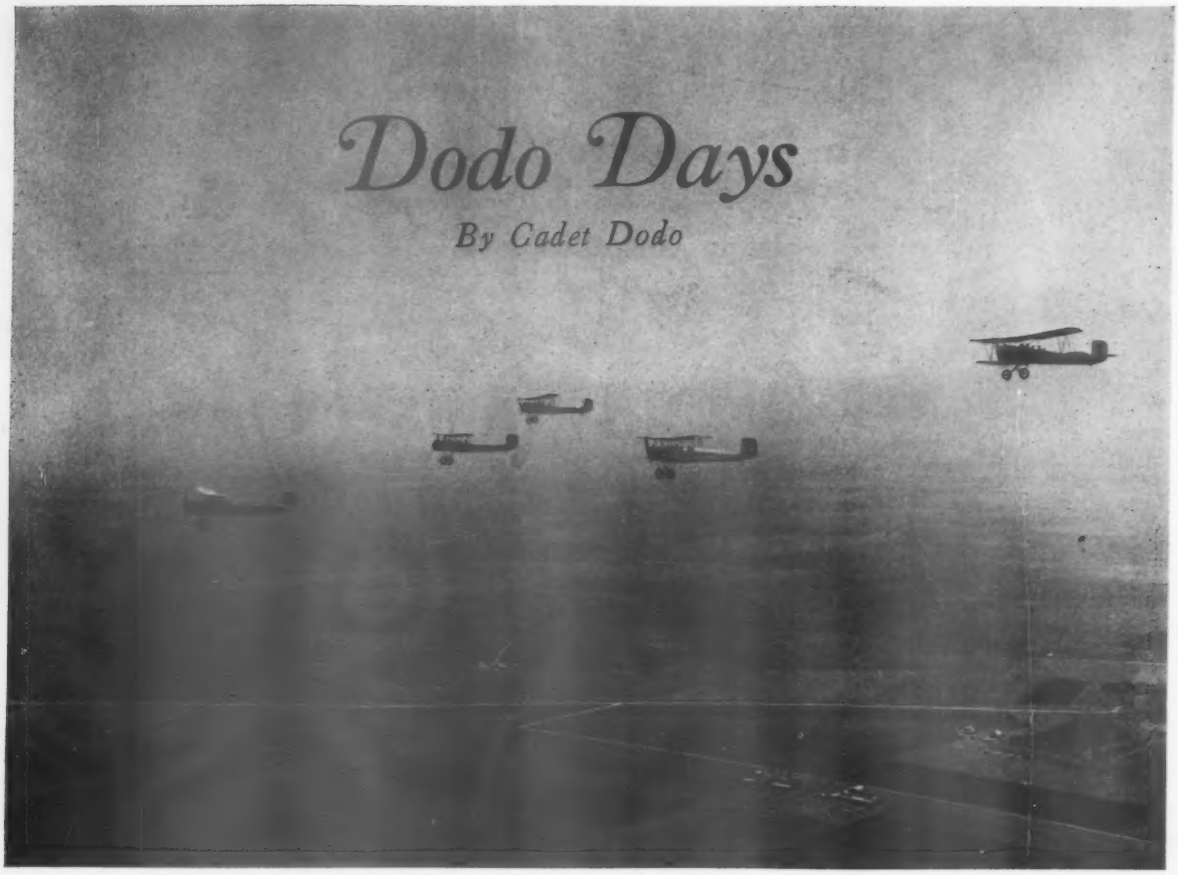
MANUFACTURING COMPANY
WICHITA, KANSAS



The Latest Type Travel Air



Cadet Life at Brooks Field

SEVERAL weeks had passed and practically every cadet had completed the special tests spoken of in the preceding installment and thus the way was clear for the start of the Ground School and the Flying training. None were sure of starting the courses as undoubtedly quite a few were to be "washed out" before having a chance to fly. Many were the doubts and the opinions expressed as to how many were to be eliminated and how important each test was counted. There were few if any who felt so confident that they need not worry about the outcome of their flying status.

"This terrible worry and almost unbearable suspense certainly is getting on my nerves," complained one of the depressed dodos as the third week passed and yet no information was available as to the outcome.

"You're not alone in this worry, so cheer up," another dodo attempted to assure him.

"Heard that we are to get our Ground School books today," said another dodo as he came up to the group.

No sooner had the words been spoken than the familiar bells were pealing forth their notice of impending action in a special formation and the mob of hopefuls rushed out to answer the bidding. In a very short time the dodos were lined up in alphabetical order and were marched to the supply room in single file to draw their supply of books.

There certainly was a formidable supply of books on all conceivable phases of Ground School work such as: Theory of Flight, Aerodynamics, Motors, Rigging, Construction, Aerial Photography, Maps, Meteorology, Aerology, Instruments, Reconnaissance, and on top of this such things as Military Law, Property Accounting, Personal Equipment of the Pilot, Training Methods and Principles of Teaching and last but not least BUZZER!

There we were at the start of a twelve months' course of Ground School and a twelve months course in flying. No doubt exists in any quarter whether a person can fly or whether he knows Aviation from the ground.

Four hours each day of ground subjects which always included one hour of Buzzer in addition to actual flying, after it got started, did not leave very much spare time for any of the boys. Most of the boys were college graduates but all of them had their troubles and often many of them wished that they could go back to college for a real rest.

This new "stuff" about the optimum angle of incidence to create the best lift to drag ratio, the effect and all about cambered surfaces, parasite drag of the struts and landing gear, the ideal aspect ratio, the effect and use of stagger, dihedral, washout, the three stabilities and how the best stability is accomplished, the critical angle in lifting, certainly did make each one do considerable thinking

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Col. Chas. A. Lindbergh was our Chief Air Mail Pilot and Instructor before he obtained his release in order to perfect plans for his epochal trans-Atlantic flight.

The Robertson School of Aviation is one of the oldest and largest in this country, and is probably the best known. It is going into its tenth year with over 500 graduates. Courses are thorough. They are complete—flying, ground work, lectures, text book study.

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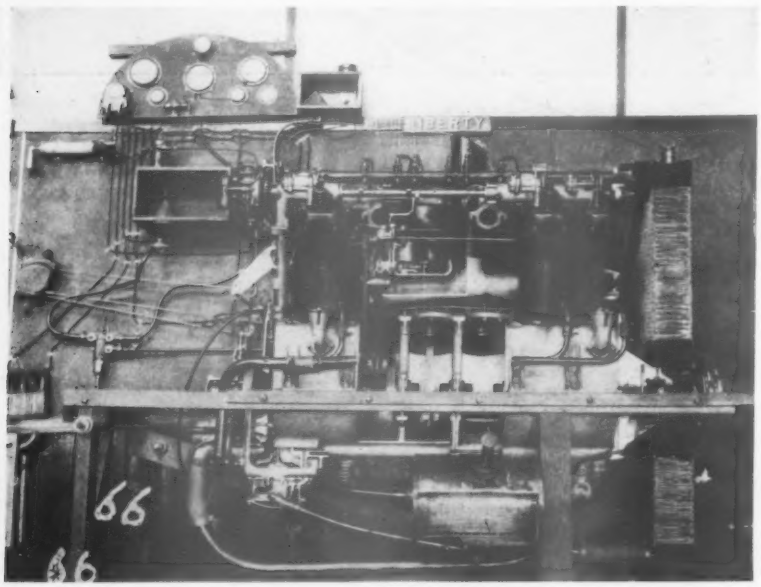
and not a little studying. The drawing and calculating of maps, the making and studying of contour maps, map scale, the calculation of the azimuth and the polar co-ordinates for points, caused every person to be plotting in his sleep. The difference between desertion and A. W. O. L., the procedure and use of the special, general and summary courts martial and many other equally dry questions as to military law and other numerous but not less difficult subjects kept every dodo busy studying and constantly worrying whether he would flunk out. Two courses would be sufficient to eliminate one just as well as flying.

But the course that all dodos "loved" was Radio Communication, commonly known as Buzzer. The constant ring in one's ear of that Da-da-da, di-da, da-di-dit, da-da-da-di-dit, di-dit and the other thirty characters almost drove one crazy after a very short time. Those infernal sounds got so that they all sounded alike and the most tiresome thing in all the world was to listen to those funny sounds. A class of this for one solid hour is like a month in the front lines. We were drilled rather thoroughly day after day on the code, taking about five new ones each day until the whole code was mastered. After that speed was required until one could receive twenty words a minute. This is rather fast should anyone care to investigate.

Every person dreaded this terrific strain and monotonous ordeal, though none depreciated its importance. Any follower of the more recent long distance flights could not fail to realize its practicability and extreme importance. I am sure that even though I stayed barely long enough to finish the code I know that the letter "O" is Da-da-da. Extreme care was taken that those deficient in their ability to grasp the code readily could have the opportunity to take "special buzzer" in the evening during the study period. The system of teaching buzzer at Brooks Field was quite fine, although quite difficult and exasperating for the student.

Even the slowest of the students and those who always have considerable trouble with anything of such nature found the mind must instantly and eventually almost subconsciously translate the various sounds to the various mental pictures that each character represented at high rates of speed. This, too, is a matter of practice, and it is surprising how one who has had considerable trouble will gradually begin to learn the code and then acquire speed.



Liberty Engine Assembly for Ground School work.

Many often make the mistake of memorizing the number of dots and dashes and thereby become hopelessly confused. Even if one succeeds in identifying by the count it will take considerably longer, and while puzzling over one character three or four will pass, never to be regained, and before realizing one becomes hopelessly confused. By memorizing the sounds well one will have little trouble in getting onto the code and gradually acquiring speed.

The strict rule was that two failures in Ground School would be sufficient for elimination from the School. One re-examination would be allowed in each course. Attendance was compulsory except for a real reason, as sickness, death or the like. The group was divided into two platoons and each was marched to separate classrooms, attending separate lectures. Grading was extremely low and high marks were few and far between.

Other courses could be described if the space would permit, but suffice it to say that all the preceding courses were quite thoroughly covered in from four to twenty or more sessions, and when a person finishes that school he is not only a good flyer but he also knows something about the why and how of flying. It is estimated that over two years of college work is given there in a period of a year mixed with considerable flying and various other training, such as discipline and drill.

"Studied your military law yet?" asked one dodo of his next dodo bunkie.

"No, I did not," replied his friend. "I had to clean my rifle for inspection tomorrow and that took two hours."

"What's all this applesauce about K2aV and L over D?" asked the first. "That's all Greek to me."

"You'll learn all about that if you want to pass the Course," his friend reassured him.

Several days passed until the terrible routine was again interrupted by another outside formation. The "All Out" from the Master Dodo attracted very slight attention from the dodos as compared to the whisperings from the fellows as they "Fell in" according to orders.

"Answer 'Here, Sir,' as your name is called, 'Fall Out' and 'Fall In' in single file on my right according to alphabetical order and await further orders."

The names were called and each cadet responded as directed, each wondering just what the decision was to be in regards to his flying status. All the cadets realized from the beginning that this was to be the result of the tests and examinations that were described in the previous installment.

All of the lucky ones were marched to the Orderly room to draw their garrison caps, and it was conceded that this was the group that was to start to fly. Just a short time previous to this all the dodos had drawn their flying equipment, which included helmet and goggles, as the re-

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mainder of the equipment had been issued upon our arrival.

One of the dodos had noticed that the students had been assigned to their instructors and that according to the notice flying was to start the following Monday. Every person placed on flying status was overjoyed and could scarcely find a way to express their elation.

But there were fourteen other dodos that were not quite as happy and could not fail to show their extreme disappointment that they were not placed on flying status, and it was generally conceded that they had flunked certain of the tests and were doomed to "wash out" before even having a chance to prove whether or not they could fly. It was a sorry bunch of fellows, and all of the others who were more lucky were quite sympathetic, but it took more than sympathy to console those downcast cadets.

"All Out for 'Flying Formation'" was the cry heard at 7:15 the next Monday morning, and the dodos rushed out to the most pleasant of formations and in a very short time each group of five cadets were lined up in front of their assigned ships and were awaiting the arrival of their instructors.

"'Tenshun! Here he comes," shouted one of the group, and all five of us stood at attention, and after he returned our salutes we could for the first time relax in the military attitude and appear and act natural. The motor had been started and was being warmed up in preparation for this great event.

"The first ride will be nothing more than a 'joy hop,' and you will follow me through on the controls, but I will be doing all the flying. You will be accustomed to the ride and regular instruction will start tomorrow," he informed us.

The one assigned first up and the instructor adjusted their chutes and climbed in the cockpits and after a brief consultation "were off." The rest of us marched over to the stage house to await our turn for the promised "joy hop" and the first of many rides—so we hoped.

Approximately forty planes were in the air at the same time and more than a hundred eager would-be flyers waited their turn. Some of them were to ride for the first time and could not quite decide just how they would like it, but one thing was certain, and that was that none would give up this chance in a lifetime for any amount of money. Dodos here and dodos there were stretching their necks in their attempt to see everything connected with the take-off, the landings, the turns, the climbs, the glides and the acrobatics that the instructors were good enough to indulge in for the great delight of the passenger.

Brooks Field's most distinguished graduate.

At last it is my turn, and after adjusting the parachute, crawling in the cockpit and fastening the safety belt the instructor taxied down the field and after running a short distance I could gradually feel the ship leave the ground and we slowly took on speed and gained altitude. I was following him through all the movements with my hand lightly on the "stick" and my feet on the rudder bar. After gaining a little altitude he made a turn and flew over to a nearby field and gave me my first lesson in flying. He started first by illustrating to me the use of the sidewards motion of the stick and we used it alone for a while and a tilting motion resulted, together with somewhat of a slip which is caused by the plane losing altitude and is known as side slipping. The rudder was then used to show how the tail is moved to one side and then the other and how skidding is accomplished. Then the two were used in combination to show just how the proper turns are to be made. Before taking me down the instructor gave me the thrill of my life by doing one of those famous barrel rolls. I cannot describe the actual sensation, but suffice it to say that it made me feel rather "funny." This was felt mostly in the region of the abdomen, as one part of it wanted to go one way and the rest and the plane in the other. For the benefit of those who have not experienced this, the greatest of all sensations, I will attempt to explain this maneuver. The plane was put in a climbing bank and I wondered just what part of the field we would hit. After getting speed by nosing it down the plane is thrown completely around and suddenly one is surprised to find that everything is as before and that the plane is flying right side up.

"That will be all for today," he said. I thought the same thing myself, and I am sure that no matter how many times one goes up the first barrel-roll will remain the most enjoyable thrill.

Several days had passed and the instructor was trying his best in teaching me to fly. Signals were used in instruction so that the instructor could easily tell the student what to do. His finger out to the right and I did a gentle bank to the right, his finger to the left and I did a left bank. His hand pointed up for a climb and pointed down for a glide. After going through several maneuvers he would shake the stick and hold his hands in the air, thus giving the signal for my taking the controls and going through the same maneuvers. If they were satisfactory he would nod his head in approval, but if not he would shake his head back and forth and would often pat his head, signifying his intention to take the controls and correcting my faults. Often he would climb into a stall, shut off the power and for the

(*Continued on page 92*)

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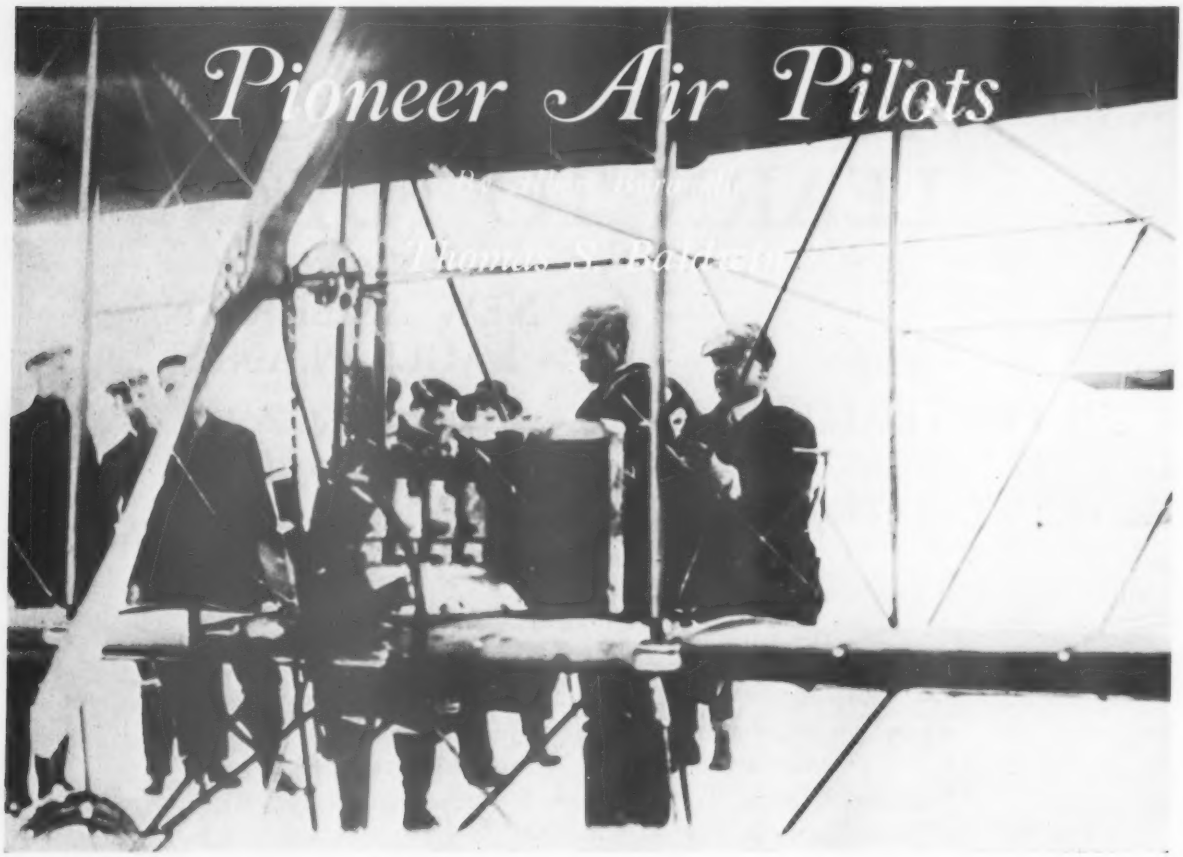

Thomas S. Baldwin in his "Red Devil."

THE subject of this article might aptly be termed the Apostle of the Air. For more than fifty years he roved the world spreading its gospel; carrying its message to the far and little known places of the earth. Some years ago while giving an exhibition in Canada he was approached by two elderly men.

"Beg pardon, sir," said one, "but we want to shake hands with you. We saw your father jump out of a balloon near Liverpool twenty-five years ago. They sang songs about him in the music halls. We've always thought that he was a little bit of the best."

"I'm glad to shake hands," responded Baldwin, "but I guess you are mistaken. My father never jumped out of a balloon anywhere. Perhaps you saw me at Liverpool. I was there twenty-five years ago with my parachute."

It seemed incredible to the two old timers; but the Captain finally convinced them. Altogether he circled the globe seven times giving exhibitions: first featuring his leap from a free balloon in a parachute of his own invention, then his dirigible, and finally his airplane.

Marion County, Missouri, was the place of his birth, and there in the neighborhood his affections centered in his later years; although he was away a greater part of the time. He was born on the 30th of June, 1854. His early years were spent amid the turmoil of the Civil War, and it is hardly to be expected that his lot was an easy one in that troublous period. He was orphaned in his early youth.

At fourteen he went to work as a brakeman on the Illinois R. R. In after life he recalled with pleasure the carefree active life he led as a railroad man. He was still in his 'teens when a circus man observed him doing acrobatic feats on a moving train. The glowing representations of life under the big top caught his fancy, and he joined the circus as an acrobat.

The circus carried a hot air balloon as a free attraction, and one of the apprentice performers was required to ride it seated on a trapeze. Baldwin was assigned to the job. He found nothing thrilling in it, and he inadvertently said as much to the circus owner one day.

"Waal, youngster," drawled the veteran showman, looking him over amusedly, "if you can put some ginger in that act I'll double your pay."

That night as the troupers gathered for the evening meal Baldwin was extremely mortified to find himself the butt of the wags who chaffed him unmercifully. He bided his time. On their arrival at Chillicothe, Ohio, he sought out his boss.

"I'll put the ginger in the act on the balloon if you'll stick to your bargain," he told him.

"What do you mean to do?"

"I'm going to do the trapeze act a mile in the air."

The circus man rubbed his chin in amazement. No one had had the temerity to try acrobatic feats on a balloon trapeze before to his knowledge; sitting quietly on the bar until safely on terra firma was quite sufficient. But it was possible. A handshake sealed the bargain.

An air of unwonted activity attended the ascension preliminaries.

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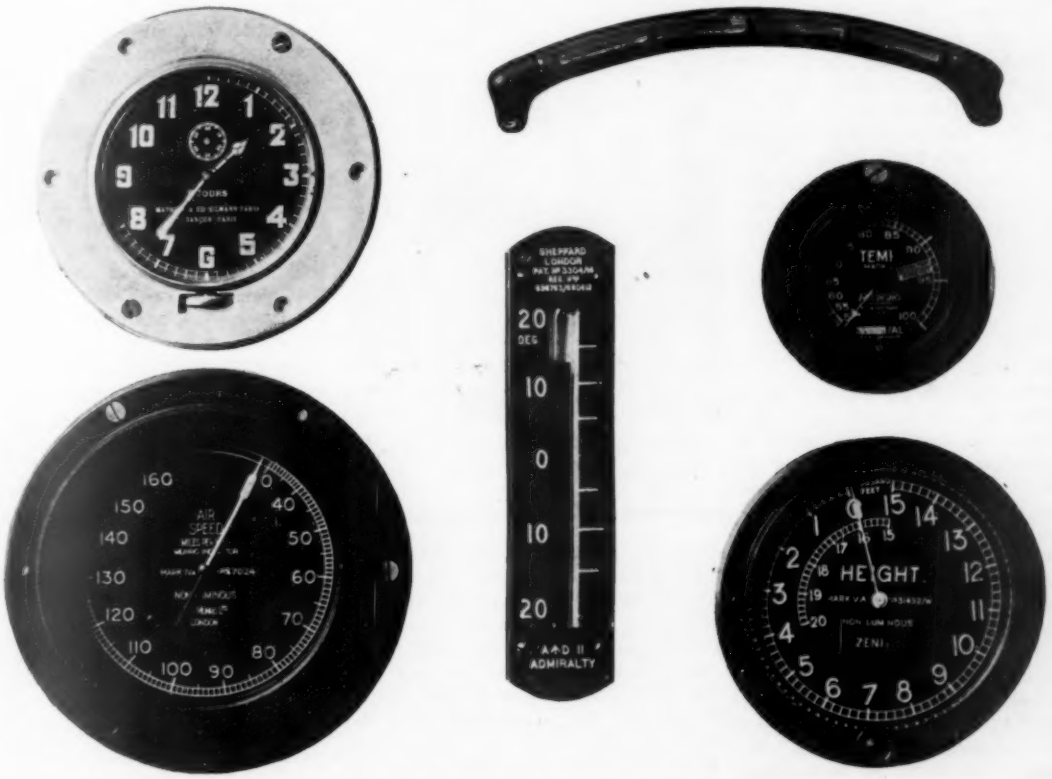

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Perched on the trapeze bar Baldwin signalled for release. Instantly the bag shot upward. At five hundred feet he began doing the acts that are usually seen under the big top with a net stretched conveniently underneath.

Gradually the gas cooled, and the balloon began difting earthward. Then a seam ripped. The deflated balloon began to drop at a frightful speed. Baldwin gave up hope. But after an interval he was dumbfounded to feel the speed of his fall checked. It rapidly decreased, and he found himself floating slowly downward, while the wind drifted him along. A glance aloft explained the matter: the fabric of the bag was bunched at the top of the netting from which the trapeze was suspended, forming a sort of parachute. The idea that it would be impossible to upset a non-rigid parachute occurred to him. He landed unhurt but thoughtful.

The showmen were enthusiastic and he got the promised raise. Nevertheless, he quit the circus in a short time. His mind was filled with the luck that had come his way under such peculiar circumstances, and he began work on his parachute. There were few books in the libraries on aeronautics, and they were not very helpful. Baldwin set out to work his own formulas and table of air pressures, acquiring considerable knowledge in the process. During this period of study he supported himself by walking high wires over waterfalls and rapids.

Eventually he designed and built a parachute which, he believed, would carry a body down from a great height safely. He tested it successfully, before trying it himself, by attaching a dog to it, and casting it from a balloon three thousand feet in the air.

At the time he was walking a high wire near Golden Gate Park in San Francisco. It was in November, 1885. One day he strolled down to Market Street, and dropped into the office of the General Manager of the street car company.

"I've finished my parachute," he told him. "I'm going up in my balloon next Sunday, and I'll jump out of that balloon as many feet as you order if you'll pay me at the rate of one dollar for each foot."

The executive, who had hired him before, consulted his schedule. An attraction was needed at Golden Gate Park for that day.

"I'll take a thousand feet of that proposition," he said. "And I hope you'll live to come in here Monday to collect that tariff."

The event went off as scheduled, and Baldwin collected. In the crowd that watched the first parachute jump in America was the man who was to become Baldwin's manager on his first trip around the world. This impresario billed him under the title of "Captain," and it stuck.

In London he was introduced to the then Prince of Wales, later King Edward, shortly before his ascent. As they stood chatting an assistant informed Baldwin that the balloon was ready. A balloon filled with hot air awaits no man's pleasure.

"If you'll excuse me I'll come right back," ejaculated the Captain.

The bag rose rapidly, and soon vanished into a bank of clouds. Suddenly the Captain plunged back into view minus the balloon. By chance he floated down a short distance from the Prince, and, as if nothing had happened resumed their interrupted conversation where they had left off. His matter-of-fact air so impressed His Highness that he drew a ring from his finger, and proffering it to him, asked:

Baldwin in the SC-1 at Fort Meyers, Virginia, 1908.

"Does that fit you?"

It did, and it ever remained a cherished possession. He was presented with the first gold medal given by the Aeronautical Society of Great Britain. Among his trophies are jewelled orders from Indian Princes, a jewelled cross presented in Russia—he was made a Chevalier in Italy and a Knight in Spain—and medals from New Zealand, Tasmania, Egypt, Siam, Australia, China, Java, Sumatra, Mexico, Peru, Brazil and Japan; in the majority of which countries he pioneered with his balloon, dirigible and airplane in turn. Among the proudest moments of his life are the dinners that were given in his honor by the Khedive of Egypt, President Porfirio Diaz of Mexico, and Gladstone.

Upon his return to this country he returned to the place of his birth, and settled down a short distance away. In Quincy, Illinois, which was ever after his recognized home, he built a magnificent house, and there he resided for some years. Then the itching foot drew him forth again. Early in 1891 he toured Asia.

After another sojourn at home he went on an exhibition tour of the States. In 1898 he conceived the project of flying from Denver, Colorado, to the Atlantic coast. He built a tremendous spherical balloon, and in October ascended. For forty-eight hours the gigantic gas bag hovered in the vicinity of Denver, at times reaching an altitude of 28,300 feet, before it was forced down.

That experience set him to thinking about the possibilities of a dirigible, or steerable, balloon. Between 1900 and 1908 he built a number of cigar-shaped non-rigid airships. The first successful one was the California Arrow. It was driven by a gasoline motor—supplied by Glenn H. Curtiss—and in it he toured the country giving exhibitions at County Fairs.

In August, 1902, Baldwin again tried a flight from Denver to the Atlantic coast. Accompanied by C. E. Shotman and Percy Hudson he ascended on the 31st. About 9:30 that night they ran into a storm that wrecked them. In a desperate effort to keep in the air they threw everything overboard. Their efforts were futile, and they landed about 2 o'clock on the morning of the 1st of September. They finally made their way to the little town of Florence, where they arrived bruised and frostbitten.

The years had dealt "heavily" with Baldwin, and he found himself to be a bit weighty for his chosen steed—they would not climb quickly enough with the combined weights of the motor and himself—so he looked about regretfully for a substitute jockey. In that way he initiated Lincoln Beachey in the way of the air, as well as Roy Knabenshue and others.

Under his management Knabenshue flew the California Arrow at the World's Fair, St. Louis. While taking the inflated bag to the fair

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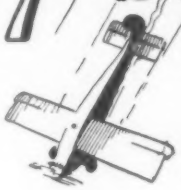

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The Air College division consists of Dormitories, restaurant, great steel hangars, 25 training planes equipped with Whirlwind, OX5 and other famous motors, complete classrooms and mechanical shops, and all the necessary and up-to-the-minute equipment. We have over $75,000 worth of training planes alone!

Our present course not only turns you out as a practical flyer—it teaches you Air Navigation, Aerodynamics, Airplane Design and Maintenance, Motor Overhaul, Theory of Flight, Shop Methods and Management, Airport Management, Air-Traffic Control—and other equally important subjects. We do not know of so complete a course in Aviation at any other school. It has drawn students from 42 states, many of them inspected other schools before selecting Parks!

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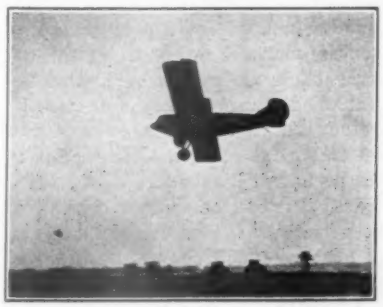
Recognize your opportunity. Before you turn this page, before you think of something else—send to us for our big illustrated book—*"Skyward Ho!"*

The coupon or your name and address on a postal card will bring it. Clip and fill in the coupon *NOW!*



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Mail the coupon with your deposit today. Then catch the next train and come to school at once to take advantage of this great saving. Parks Air College, Inc., 206-F Mo. Theatre Bldg., St. Louis, Mo.

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☐ I would welcome your FREE book—"Skyward Ho!"

☐ Attached money order for $25—Reserve my place in School at $295 rate for full flying and Regular Ground Course. I will be there.....19....

Name.....

Address.....

grounds it was necessary to pass it over a trolley wire and, through some misunderstanding, the front and rear ends were released together. Away she sailed. The next morning Baldwin was notified that it was sixteen miles southwest of St. Louis; its anchor rope had caught in a tree and there it was found, practically unharmed, by farmers.

Early in 1905 the Baldwin Airship Company was incorporated. The California Arrow was sold, and Knabenshue was replaced by Beachey. On the 23rd of August the City of Portland flew over the city it was named after with Beachey at the helm. The 29th of June, 1907, was the date of Glenn H. Curtiss' first flight, and he ascended in Baldwin's airship.

Baldwin had the ability to handle people. In 1907 the Signal Corps, U. S. A. ordered a 20,000 cubic foot non-rigid from him. He instantly gathered engineers, aeronautical students, professors, military experts, boatbuilders (for the framework), fabric experts, attaches of the Bureau of Standards and aeronauts. Naturally the ideas of this individually trained group conflicted; but the Captain saw that the work was finished on time.

The SC-1 was delivered to the government the following summer. It was the first aircraft purchased by this country. A cigar shaped envelope of rubberized fabric, 96 feet long and 19½ feet in diameter, it was surrounded by a network, from which a long rectangular trellis girder was suspended by steel cables. This girder, or car, carried a twenty horsepower Curtiss water cooled engine which through a shaft transmission actuated a tractor propeller. It gave a speed of twenty miles an hour. The pilot sat behind the engine, and in front a biplane stabilizing and trimming plane was mounted, while on the stern of the girder a cruciform tail insured vertical and directional control. The total lift was 1,360 pounds.

The SC-1 was tested successfully before a committee of government officials on the 4th of August, 1908. On her the early military aeronauts were trained. Lieuts. Lahm and Selfridge were placed under Baldwin's guidance.

The following announcement appeared in the N. Y. World on the 31st of January, 1909:

"The World's $10,000 airship prize is offered to the person who, during the Hudson Fulton Celebration in 1909, duplicates in the air with a mechanically propelled airship the trip of Robert Fulton's steamboat, from New York to Albany, a century ago."

Baldwin tested his Hudson Fulton airship at Worcester, Mass., on September 7th, to the great excitement of the neighborhood. He then went to New York City to prepare for the flight. But one competitor, George L. Tomlinson, appeared and they ascended together from "Fulton Flight Square," as 120th Street and Riverside Drive was designated. Ten minutes after the start Baldwin's craft began to descend. Frank Kane, steward of the Peter Pan Club, happened to be handy in a rowboat, and he caught a dangling rope and pulled

John Mears and Captain Collyer, pilot (left to right) who circled the world in 23 days, 15 hours and eight seconds, with their mascot "Tailwind." This beats the 28 day record of Linton Wells and Edward E. Evans.

him to shore. Tomlinson came down further along the route. The prize, after an extension of the time limit, went to Curtiss the following year.

The increasing activity in aviation turned Baldwin's thoughts in that direction. He joined the little group of enthusiasts who were encamped on historic Hempstead Plains, and began work on a plane of his own design. Several months later he was teaching himself to fly in it. He was confident that he could fly it with very little practice. One afternoon he determined to put his ability to the test. It was a nice June day—the 18th to be exact—when he had the plane wheeled from its hangar. After tinkering about it for a bit he climbed into the seat, and thrust the throttle wide open. He bounced into the air before he realized it. Accustomed to air travel—with twenty mile speeds—but unfamiliar with the mile a minute variety he became confused, and before he knew what was happening his biplane set a course for a telegraph pole. It hit the wires, and wrapped itself around the pole, leaving the Captain dangling from a cross arm. Baldwin reached the ground sore as a boiled owl, and his language was not exactly calmed by the sight of a young miss who stood laughing heartily at the mishap. Quite the opposite. The girl ceased her levity, and, before she retreated, sneered:

"Old Red Devil."

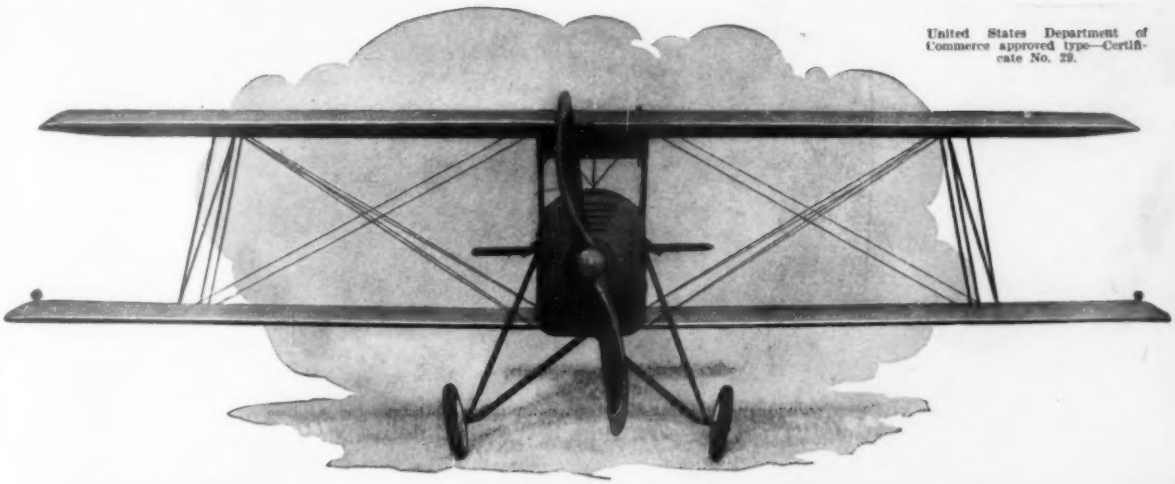
That gave the Captain an idea, and he named his ship, "The Red Devil." In a short time he was flying capably enough to take pupils. In July he flew westward. At St. Louis he made a flight of thirty-two miles down the Mississippi River passing beneath the five bridges that span the Father of Waters at that point. On August 28th, he flew for Mayor Mitchel; on September 5th, he became lost in a fog, and sighting another plane he followed it back to the field. Toward the end of that month he was flying in Kansas, and on October 13th, he crashed in the Red Devil at Iowa City, Iowa. He returned to New York.

The Captain, as he was affectionately known, now made preparations to introduce the latest aerial contrivance to the hinterlands. In the company of Bud Mars and Tod Shriver he sailed from San Francisco on a thirty thousand mile exhibition tour. They returned in April, 1911, after a most successful trip.

Late in 1911 he again toured the Orient, this time with Lee Hammond as his companion. On April 23, 1912, arrived back in New York. About the end of the year he gathered a group of fliers, most of whom he had personally trained, and again conducted a highly successful tour of the East, returning in the spring of 1913.

Baldwin was now a comparatively wealthy man; he owned thousands of acres of land in Missouri, and he controlled an entire suburb of Quincy, Illinois. His home there was an elaborate and imposing edifice, but he hadn't lived there in eighteen years. Instead he contented himself with typical hall bedrooms and meals at obscure lunch counters wherever he happened to be, while his family

(*Continued on page* 91)



United States Department of Commerce approved type—Certificate No. 29.

Air-King shock absorber struts are of hydraulic compression type.

Air-King under-carriage provides strength for the unskilled student flyer. Landing strain is absorbed and distributed to six points of the welded steel tube fuselage.

Flying wire fittings are securely welded to the steel fuselage, providing dependable strength.

Fast-Safe-Economical Payload Airplane for Students, Owners and Operators

Outside appearance is an indication of inside quality — the clean cut "Air-King" Model 28 is a wonderful piece of workmanship clear through.

Here's an airplane you will be proud to own and fly. Fuselage of weldless, seamless steel tubing; ventilated cowling; steel streamlined struts; shock absorbing under-carriage; streamlined flying, drift and load wires; aluminum disc wheels; full width wind shield; head rest and roomy cockpit are only a very few of its many advanced advantages.

Illustration above shows how completely "Air-King" engineers have cut down parasite resistance—providing speed with ease of control. Wide tread under-carriage protects wing tips in landing on uneven ground. Side sway is lessened. Full forward vision provides worry-free flying.

Positive lateral control (even at stalling speeds) is insured by long, narrow cord ailerons. Pilots will appreciate the complete dash equipment, which includes: tachometer, contact switch, water temperature gauge, altimeter, oil pressure gauge. Adjustable stabilizer control and throttle are within easy reach. Finely balanced dual controls are provided.

Specifications of "Air-King" Model 28

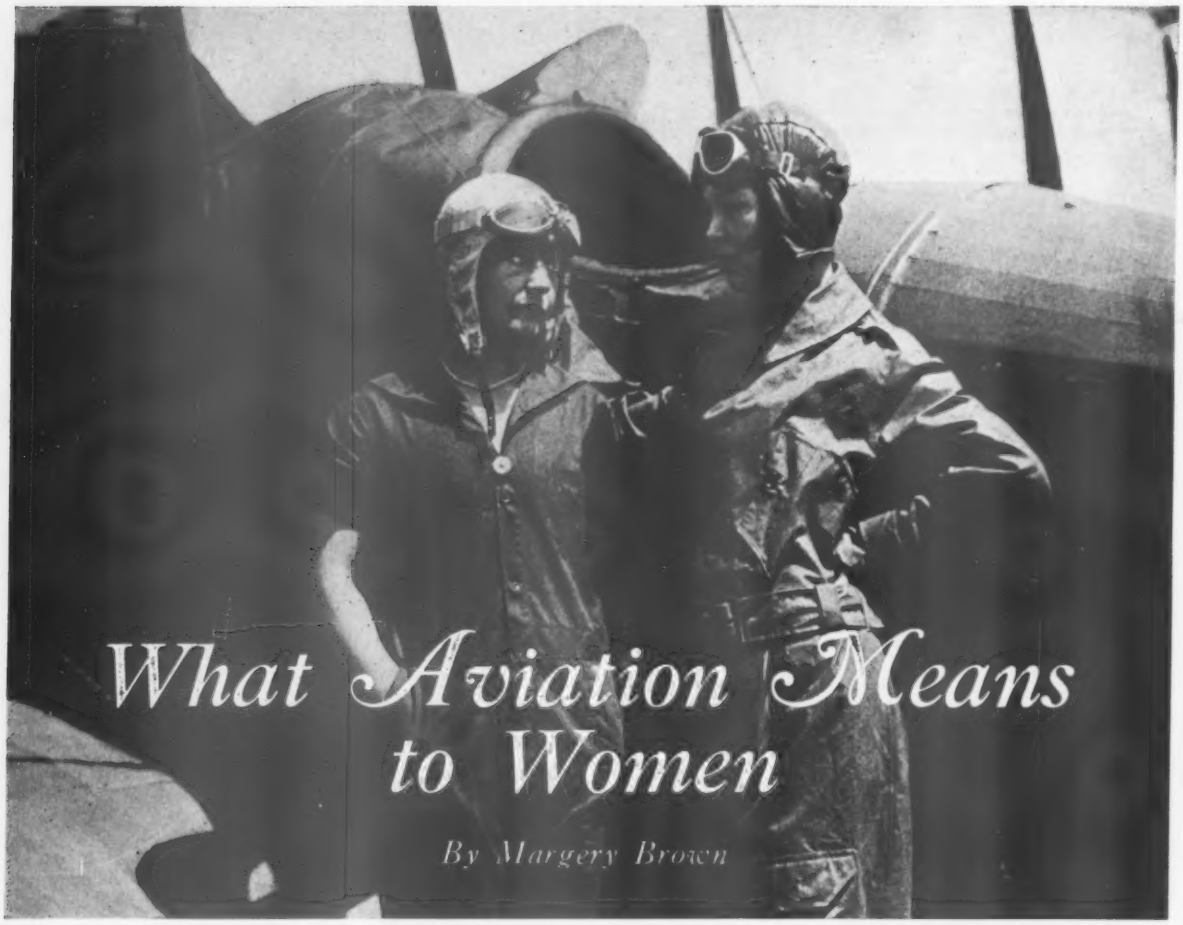
Span, Upper Wing, 31′ 2″
Span, Lower Wing, 34′ 1″
Chord, top and bottom, 5′
Aspect ratio, 6.20′
Stagger, 15″
Sweep Back, None.
Dihedral. Lower Wing, 2½ dg.
Dihedral, Upper Wing, None.
Wing Area, 310 sq. ft.
Airfoil section, Clark Y.
Height Overall, 9′

Length Overall, 25′ 5″
Weight, Empty, 1,340 lbs.
Wing loading, 6.80 per sq. ft.
Speed, Maximum, 99 mph.
Speed, Cruising, 85 mph.
Speed, Minimum, 35 mph.
Useful Load, 775 lbs.
Fuel Capacity, 35 gal.
Radius, Maximum speed, 396 miles.
Climb, Initial, 600′ per min.
Ceiling, 15,000′

Just off the press—a supplement to our Air-King Catalog that describes fully Model 28 Air-King.

National Airways System

Field 6, Lomax, Illinois



What Aviation Means to Women

By Margery Brown

Margery Brown and Barbara Young. Miss Young is a Chinese girl student at Curtiss Field.

"WHAT does flying mean to you?"

That is the question I have been asking women on the flying fields, where dozens are flocking nowadays, eager for instruction. The replies are as varied as the women, and as interesting. Apparently, flying does not mean precisely the same thing to any two women. Each one is actuated by different desires, ambitions and motives. A few of them do not even know why they fly; they feel the urge, and forthwith obey the impulse!

It is quite clear to me why I fly. I would not think of flying if it did not uplift me mentally as well as physically. To me, it invariably means uplifted thought; freedom from thoughts that center upon self. But to various people it symbolizes different things.

One woman told me that, to her, it represented "a conflict and a victory"; a conflict with an inner fear as well as with the region of the air —and a two-fold victory; moral as much as physical.

Of a man well known in the aviation industry, who for a number of years has made flying his business, I seriously asked, "Just what does flying symbolize to you?" And he made me laugh by answering laconically, "Bread and butter!"

But, to most of us, flying is still enough of a novelty to be an emotional experience, and questioning various women about their reactions, brings forth interesting information.

Women began to enroll for a course of flying instruction at Curtiss Field, shortly after Lindbergh's epic flight across the Atlantic. Speaking of Lindbergh, it is undoubtedly a fact that he inspired most of the women; one told me frankly that, had he been homely and past forty, she never would have yearned to fly! But despite the romantic inception of the desire, she has become an excellent flyer.

Lindbergh himself is a symbol, more or less. It isn't Lindbergh as a person who inspires them so much as it is Lindbergh as an ideal. They recognize in him, qualities they would like to possess—courage, quiet confidence, modesty and spiritual freedom—and in seeking to make these qualities their own, they naturally follow along the trail he has blazed.

Margaret Huber, of New York City, was one of the first women to enroll for the course. She began to fly about a year ago, with Lieutenant Kitchingman as her instructor. From the beginning she was a very satisfactory student, and was ready for her first solo flight at ten hours. This is an unusually short time for a woman to solo. Since then she has progressed steadily. She is cool and businesslike about her flying. Not easily excited, of a rather nonchalant temperament, she flies as much for the delight it affords her, as for the furthering of her ambitions. Miss Huber has every intention of taking up flying as a career, and believes that there are plenty of opportunities

MFS
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for women in commercial aviation.

She likes to fly open cockpit, not in a cabin plane; thrills at what she believes is the risk involved; loves the freedom and the physical sensation of wind blowing strongly against her face; and she glories in the power, the exultation. Flying makes her feel as if she had gained the upper hand; as if, so to speak, she could make a face at the world, and stick out her tongue in derision like a naughty little girl, when she is flying at a thousand feet, and speedily leaving the earth behind!

This sensation of reckless abandon does not appear to have any place in the experience of Clarissa Cooper, another woman student who had her training from Lieutenant Kitchingman. Miss Cooper takes flying very seriously, is conscientious and careful, and is anxious, not only to fly well, but to fly with the greatest safety. She believes it is the greatest sport there is.

Miss Cooper has done exceptionally well, and has already obtained her private license. When she has had sufficient experience, she would like to sell and demonstrate planes. It seems that there might be an opportunity in this field, especially if women take up flying to any extent. A woman who was buying a plane would undoubtedly be predisposed in its favor, when she saw that another of her sex was able to fly it without any difficulty.

One cannot help but wonder if women will want little luxuries in their planes, such as they have demanded in their automobiles; ash trays, mirrors, lipsticks, flower vases and the like. Let us hope that a law will be enacted to prevent the placing of mirrors in conspicuous places; else the number of crack-ups will be enormous. With a mirror in the cockpit, too many women would be far more interested in their looks, than in their landings!

Mrs. Margaret O'Mara obtained her private license in record time. She has two little children, and has frequently brought them to the field, where she would leave them on the ground with a nurse, while she went up for instruction.

To her, flying means an added vital interest in life. She finds it a great satisfaction to strive to excel, and to succeed. The effort to become skillful is what attracts her. This striving for skill is one of the greatest attractions flying has for Miss Cooper and Miss Huber, also. Mrs. O'Mara is as well satisfied with an especially good landing, as a woman on the links would be, if she had made a "hole in one"; and just as annoyed with a bad landing as that same woman would be, if she had played a very poor game of golf. Although she is the only student at Curtiss Field who is a mother, she considers it no more unusual for a woman who has children, to fly than to drive an automobile.

Few of the women are interested in motors. They want to learn as much about their planes as is necessary in order to pass the Department of Commerce tests, and one or two have been heard to declare that they would like to be able to make minor repairs when occasion demands; but it appears that women, as a class, prefer to enjoy flying, and let the mechanics do the work.

Other students at the field include a Follies girl, a debutante, a college girl, a flapper, a school teacher, an actress, and a society matron. To each of these women, flying has a different meaning; and each one is finding just what she is seeking.

Aviation is so varied in its many phases that one might safely say of flying, what frequently is said of life itself—you get out of it, just what you put into it!

Topeka Airport

An airport has been dedicated at Topeka, Kansas, that has supplied a long-felt necessity to the city. The field covers 80 acres of turfed land that has never been plowed. In addition to this, there are 80 acres, which when cleared will provide plenty of space.

The pilot's rest room is a feature that has lately been completed, with radio, lounges and other conveniences. Students are taught to fly by R. M. Thompson, chief pilot, and to parachute jump by W. E. Lange. It is situated six miles southeast of the city on a state highway, and can be seen from the air for miles, as the surrounding country is devoid of hills, buildings, or other obstructions.

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And every American Eagle is designed and built to the same high standards of safety, performance, dependability and beauty which have become traditional with the American Eagle. You will find stability, ruggedness, speed and maneuver-ability which make the American Eagle the leader in its power and price class.

A letter will bring you complete information on the American Eagle powered with the motor in which you are most interested. There is a distributor near you who will gladly demonstrate the qualities which make the American Eagle the outstanding light commercial plane.

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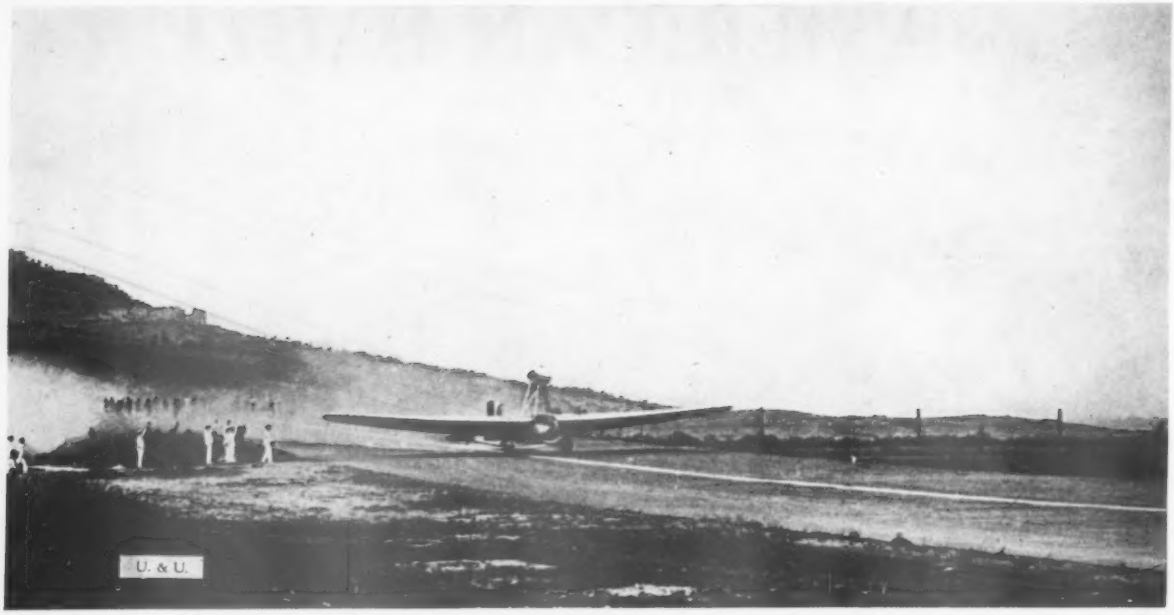

A New Distance—Duration Record

Left Rome Tuesday afternoon, July 3rd, at 2:12 p. m. Total distance covered: 4,488.2 miles (new world's non-stop record). Total time: 51 hours, 39 minutes. Route flown: Across Mediterranean Sea, through the Straits of Gibraltar, southward over the Atlantic via the Cape Verde Islands to Brazil. Flight made in Savoia-Marchetti with 550 h.p. Fiat engine.

Capt. Arturo Ferrarin **Major Carlo del Prete** **Allesandro Marchetti (designer)**

If you're a Man of Action Read Every Word on this Page

Walter Hinton

Pilot of the NC-4—*first* plane to cross the Atlantic. *First* to fly from North to South America—and *first* to explore the jungles of the Upper Amazon. During the War he was an expert Navy flight instructor. Today he is training ambitious men for Aviation. He can help YOU!

TWO YEARS from now will be *two years too late* to capitalize the opportunity that is YOURS TODAY in *Aviation!* Not that you wouldn't be able to break into the field then. But you'd be handicapped and outdistanced by the wiser ones who started when the time was ripe.

Don't make the mistake of thinking that the big boom in Commercial Aviation is five or ten years off. It's here NOW!—TODAY there is tremendous growth, tremendous profits in the Air. A vast network of mail, express and passenger service blankets the country; and it's getting bigger all the time. Almost every month more millions are being invested in planes, plants, airports, airways.

The right start, rapid progress and the Biggest Success depend on getting into Aviation NOW! This is no time for doubting or hesitation. Thousands of good jobs—*big-pay* jobs—are open in over 40 fascinating branches of work both in the air and on the ground. They will be filled as fast as men can be trained for them. The man who ACTS TODAY is the man who two years from now will thank his lucky stars that he KNEW enough to *start SOON enough!* YOU can be that man!

I Will Train You Right at Home for Job You Want at the Pay You Want

In every part of the country, my students are stepping into jobs that *pay*. The training I give them—and am ready to give YOU—covers the fundamental facts; a real working knowledge of motors, plane design and construction, rigging, instruments, repairs, theory of flight — Aviation, the Airplane and the Airport.

Understand, you take this training *right at home*. My course is backed up by over 12 years in Aviation and over 400,000 miles of flight. It is endorsed by some of the biggest men and biggest corporations in the field today. It trains you thoroughly, gives you a foundation for a real start, real progress and a real future in the livest, fastest growing industry the world has ever seen!

The book shown below talks facts. It shows you exactly *where* you can fit into Aviation—*how* I train you and how to get *started*.

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New Seaplane Records

The Navy flying boat, the XPN-12, Type A 7383, broke six world's records for seaplanes of its class during a recent test at the Philadelphia Naval Yard. The records are as follows:

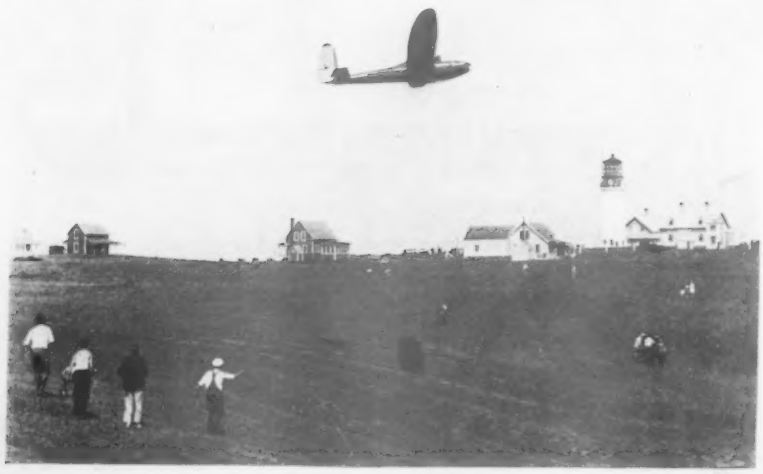
(1) Duration record of 19 hours, 39 minutes, 51 2/5 seconds against the former record of 11 hours.

(2) Range of flight equaling 2,150 kilometers, or 1,350 miles, bettering former record by 302 miles.

(3-4-5) Averaged 83 miles per hour, and broke world's records for carrying weights of 1,102.3 lbs.; 2,204.6 lbs.; 4,409.2 lbs.

(6) Traveled 1,350 miles with a load of 2,046 pounds against former record of 1,248 miles with equal load.

Lieut. A. Gordon, who piloted the Navy boat to six records.



Glider Record

The "Darmstadt" sail plane flown by Peter Hesselbach recently established a new United States record for gliding at Cape Cod, Mass. Mr. Hesselbach remained aloft for four hours and five minutes in this sail-flyer ,which is a replica of the plane in which Ferdinand Schulz established the world's record of 14 hours and 23 minutes.

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John P. Wood, flying the "World's Most Efficient Airplane," wins with quickest take-off, and shortest landing, combined with greatest speed and load per horsepower, plus the ability to maintain a fast schedule in rough weather over rough country.

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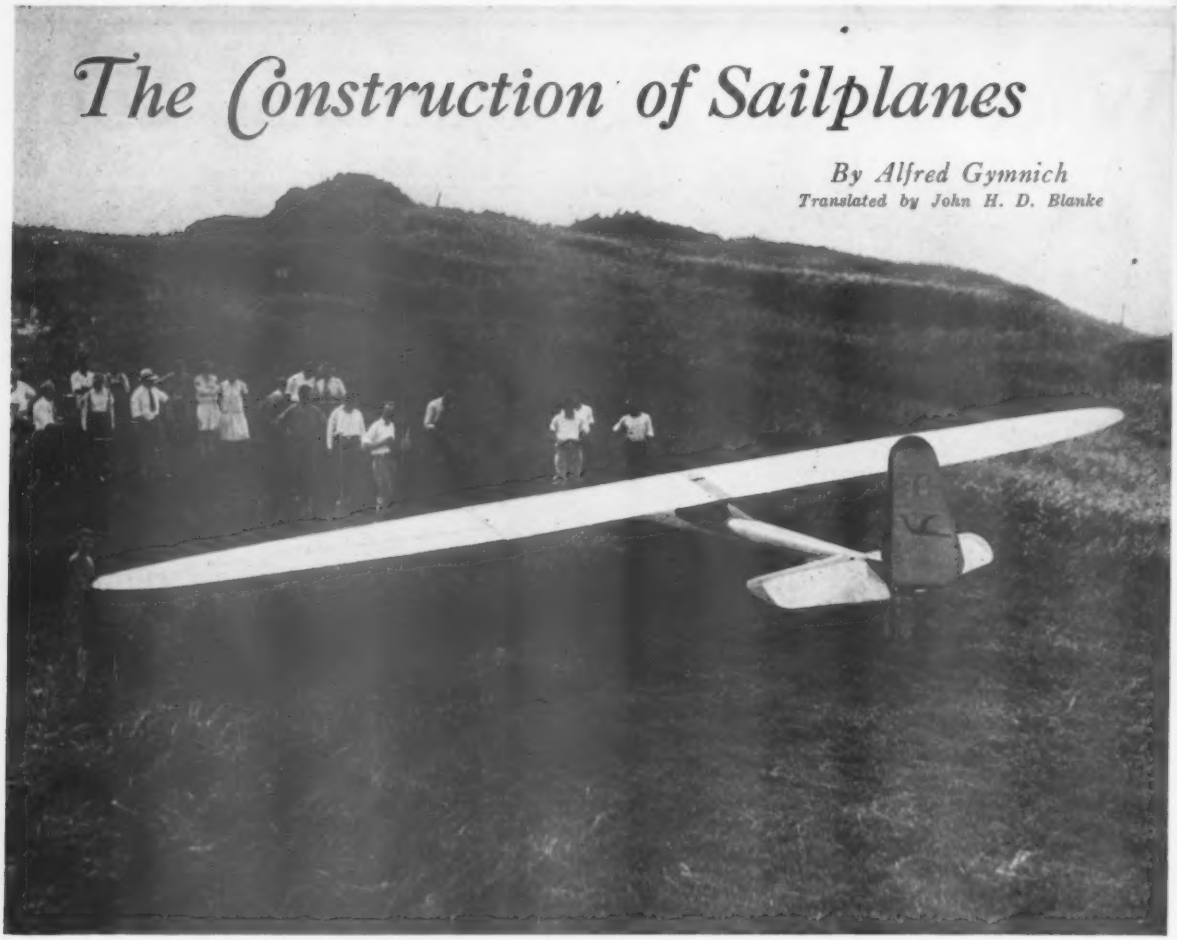
Write for Catalog

WACO AIRPLANES

The Advance Aircraft Co., Troy, Ohio

The Construction of Sailplanes

By Alfred Gymnich
Translated by John H. D. Blanke



A Darmstadt Glider plane, a replica of the craft that stayed in the air more than 14 hours.

Popular Aviation now places before its readers the first installment of a complete course in the construction and operation of sailplanes prepared for American enthusiasts by Mr. Alfred Gymnich of Hamburg, Germany. He is an outstanding authority on sail flight and other aspects of flying.

IN attempting to familiarize the reader with the construction and the building of sailplanes, the author is aware that in starting this series of articles that it is not practical to deal with the scientific data at hand in a theoretical way. Since the majority of interested persons have so far been reluctant to build and fly sailplanes it is obviously best to treat the material from other than a scientific standpoint. For this reason the author has been guided by the policy of presenting this special field of flight engineering to the reader in a combined technical-practical manner, so to speak, so that it will be possible for enthusiasts to start with the construction of simple sailplanes on the basis of the practical knowledge and experience laid down in these articles. From this point he may proceed step by step to the successful operation of these sailplanes.

First, however, a few remarks must be made to explain this scientific sport.

The sailflying movement, which had its real beginning in 1920 in Germany, has blossomed here (in Germany) during the course of eight years into a truly ideal sport. Even though sailflying does not receive the publicity given to other types of sport, the fact that there are over 100 societies which foster sailflying speaks for itself.

There is perhaps hardly a sport which, to a like degree, requires more courage, presence of mind and ability for quick decision. Nor is there one which brings to fulfillment the desire which slumbers in every human heart to lift oneself into the free air like the birds. It is these qualities which bring into sailflying a continuously growing inflow of youthful followers; for courage and ability of decision are the especial attributes of youth.

In the United States, the country of "unlimited possibilities," as it is still always called with pleasure by us, one cannot thus far speak of a real sailflying sport. As in other countries the timid experiments of beginners have been made, and some few men have attained great proficiency, but no organized attempt has yet been made to make a sport of sailflying and gliding.

Viewed historically, the United States is the mother country of sailflying flight, for it was no less a person than Orville Wright who succeeded in 1901 at Kitty Hawk in

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HUNDREDS OF MILLIONS are already being spent in Aviation. BILLIONS more will be spent in the next few years. It is one of the Biggest Pay Industries of today. It is doubtless the most fascinating of uncrowded professions. Find out about it now, while you can get in on the Ground Floor.

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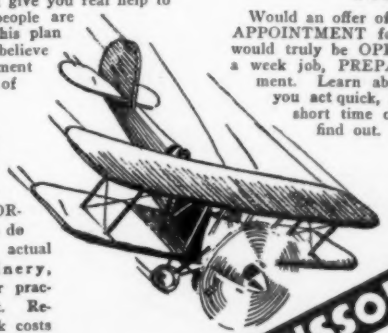

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making the first pure sailing flight of ten minutes duration. However, the experiments of the Wrights found no disciples and the real development and the systematic building up of the sailflying movement remained reserved for Germany, whose hands were of course tied in respect to the building of motored planes by the Treaty of Versailles. This occurred at the time of the first Rhoen sailing flights. The lead which Germany has acquired in this field today is perhaps best illustrated by the fact that all the world records in sailflying are in German hands.

By sailflying we understand a flight without any kind of motor or other driving power—in which the energy required for the flight, without loss in altitude, is taken solely from the air currents. This distinguishes static and dynamic sailflying. Static sailflying is limited to the landscape, that is, dependent on it, whereas the latter, or dynamic sailflying, is based on the utilization of the inner energy of the wind, among which are turbulent air currents, inversion layers and the like.

Static sailing flight is based upon the utilization of thermic ascending winds, as they are conditioned by the differences in the condition of the landscape, and upon the utilization of slope winds. It has not as yet been proved that man has achieved actual dynamic sailing flight, and it is difficult to prove sailing flight in ascending thermic air currents.

All great sailing flight achievements have been made in slope winds. For that reason we will concern ourselves only with static sailing flight and will analyze first of all the cause of the upward directed slope winds and their utilization for human sailing flight.

The wind which blows against an obstruction is forced by the resistance of the air, or its power to persist, and by the air which flows after it, to escape either to the sides or upwards. Since the air current always flows naturally in the direction of least resistance it will pass the cone of a mountain, for example, to the side, but in the case of a long extended hill range, it will pass over it, due to the greater resistance at the sides. In other words, the wind adjusts itself to the contour of the landscape, as illustrated in Figures 1 and 2.

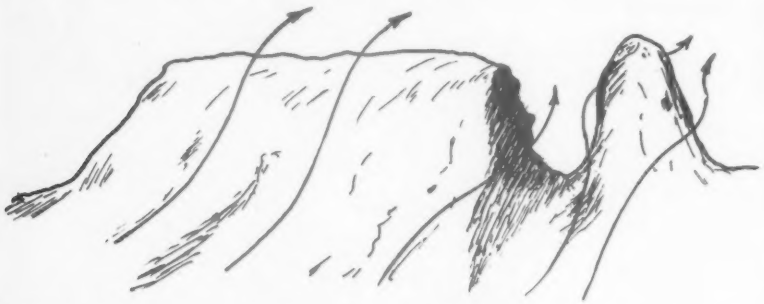


Figure 1—Deflection of the wind on a mountain cone and on a long extended hill ridge.

This ascending air current, which is defined as a slope current, forms the source of energy for sailing flight. The extent of the upward component, or the upward force, of this slope wind depends upon the strength of the wind and upon the contour of the landscape.

In order to make sailing flight possible, and to achieve a flight without loss of altitude, the upward component must at least be proportional to the sinking speed of the sail plane in quiet air. That is: the wind must flow, in a given unit of time, the same distance upward as the sailplane would glide downward in still air. If the ascending speed of the wind is greater than the sinking speed of the sailplane this energy can be utilized for ascending by means of making the correct changes in steering and control.

The principle of motorless flying against ascending wind is illustrated in Figure 3. "A" represents the wing profile; "B" the wind direction; "C" the vertical component; "D" the resultant of the wind pressure; and "E" the horizontal component, which drives the plane ahead against the wind, which is, of course, analogous to the case of a sailboat.

In Figure 4, the flight of a sailplane in a slope wind is shown schematically. The drawing conveys proof, with little difficulty, of the fact that the upward component of the wind is, in a given case, greater than the sinking speed of the plane; so consequently we have a flight without loss of altitude; and thus a gain in altitude is possible. As long as the sailplane remains within the range of this ascending slope wind it cannot sink, provided it is not pressed towards the ground by the flyer in operating the controls.

The reader can readily see that the duration of a sail flight is limited merely by the wind conditions and the physical endurance of the flyer himself. It makes no radical difference what way the pilot utilizes the slope wind for a duration flight. With grades that are high, from an aerodynamic standpoint, and with speedy and flexible planes, the pilot will, as a rule, describe circular or eliptic courses within the zone of the ascending winds. However, a slow machine, inert in the curve, is con-

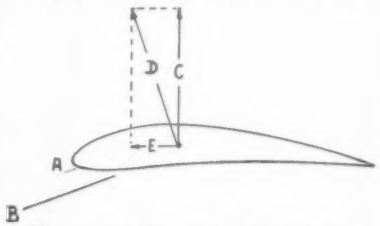
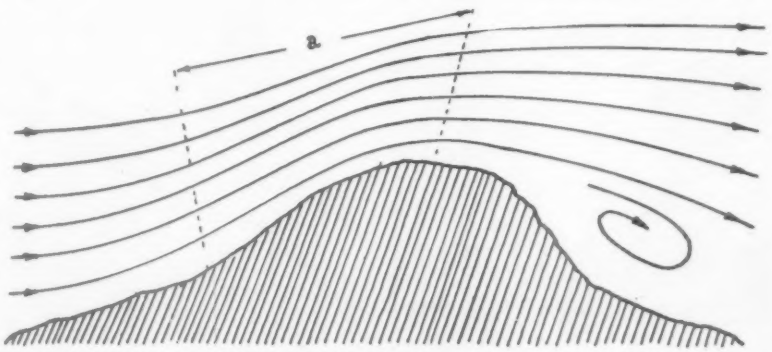


Figure 3—The principle of the motorless flight against the wind. Parallelogram of Forces.

Figure 2—Cross section through hill ridge. The letter "a" indicates the zone of the ascending wind most favorable for a sail flight.



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CHAPTER THREE
Inherent Stability
Stability Defined—Relation of Momentum to Stability—Longitudinal Stability—Why a Plane Flies "Hands Off"—Directional Stability—Propeller Torque—Dihedral—Losess due to Dihedral.

CHAPTER FOUR
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Aspect Ratio—Stagger—Monoplane or Biplane—Tail Skid—Airplane Engines—Water Cooling vs. Air Cooling—Cost of Airplane Engines—The Propeller.

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Wings—Fuselage—Monocoque Fuselage—Landing Gear—The Empennage.

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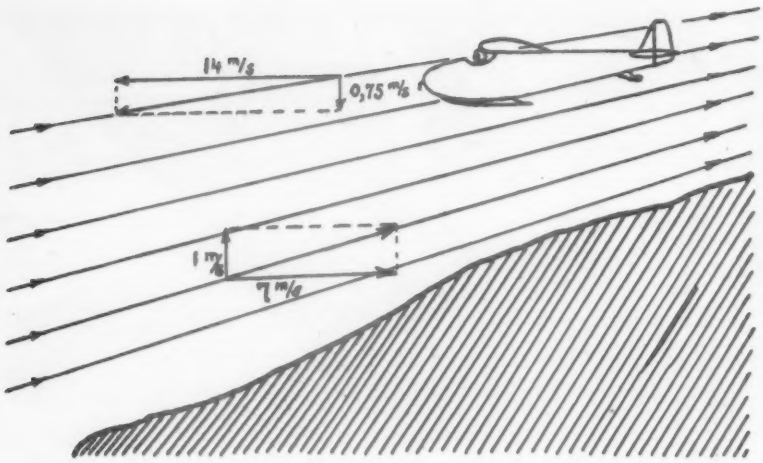


Figure 4—Schematic representation of slope wind. The resultant of Flying Speed and Sinking Speed give Gliding Angle.

sidered better in the ascending wind if the pilot adjusts it to slant against the wind and permits it to push parallel to the slope.

In distance flights the conditions are somewhat different, for here the pilot must first of all endeavor to gain the greatest possible altitude above the surrounding landscape. Only after attaining this altitude can he make a distance flight, by keeping in mind the fact he must lose a minimum of altitude and utilize, as skilfully as possible, every slope wind in order to gain more altitude. To coin a word, an especially high "flyerial" feeling is required to make exceptional record flights. For example, Ferdinand Schulz, the holder of all world records, among which is the distance record of over 60 kilometers or 37 miles. When it is known that the dune territory, above which this flight was made, has a dune height of only 1 meter, or 3.3 feet, over a distance of about 3 miles, one understands what a highly developed "flyerial" feeling is necessary in order to achieve such a performance.

Regarding the construction of sailplanes, a few general facts must be understood at the start. It might appear to the casual observer that a sailplane differs from a motored plane merely by the absence of a motor and the necessary changes required in dimensions and weights to balance the loss of the motor weight. This is not the case, and even though a few sailplanes are merely imitations of motored planes, and even though sailing flights have been made, under especially favorable conditions, in normal motored planes with the motors stopped, there are essential differences between the two.

In the course of time experimental developments have shown the necessity and advisability of deviating from motor plane construction. This makes it necessary to discuss, accurately and in detail, the individual construction parts of the modern sailplane.

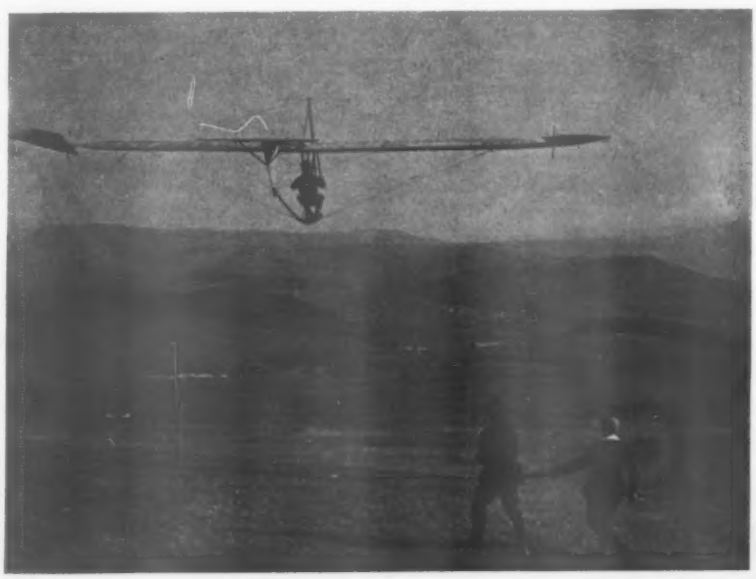
First of all it is necessary to group sailplanes into classes. It is not always possible to make a definite distinction between gliding and sailing planes, for here and there sailing flights have been made with primitive gliding planes (see Figure 5), whereas aerodynamically high grade sail planes frequently do not go beyond simple gliding flights. To a large degree performance depends on the skill, ability and adaptability of the pilot. In the first case the pilot of the glider, through great skill and ability managed to achieve a sail flight, while in the second case, the pilot of the high grade sail flying plane possessed too little skill and experience, and failed to translate the aerodynamic advantages of the superior machine into an actual flight. For that reason the motorless planes are not classified into gliding planes and sailplanes.

The chief method of classification is according to the nature of the control. As follows:

1. Planes controlled by displacing the body weight.
2. Planes controlled by laying out the rudder.
3. Planes controlled by the wings or carrying surfaces themselves.

In the first group, planes which are steered by displacing the body weight, are, in general, called suspension or hanging gliders. (See Figure 6.) Most of the motorless planes of the first period of development, up to the time of the first motored flight, that of the Wrights in December, 1903, belonged to this category. This is easily understandable, for the hanging glider exacts the minimum of constructive requirements and can be built with the smallest outlay. It can be seen that the primitive steering, by means of displacing the body weight, sets a certain definite limit to the size and weight of the hanging glider. Furthermore, since this type of control

Figure 5—The first sailplane of Ferdinand Schulz, cheaply constructed. Flap valves at end of wings maintain lateral balance.



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is neither speedy nor sensitive, it is effective only with weak winds or none at all. Stronger gusts or winds become dangerous to the hanging glider even under the most expert piloting.

For that reason the hanging glider has played only a subordinate part in development in this field. Also, for schooling or practice purposes it is by no means such an ideal machine as it is so often described, for starting, flying and landing require more courage and skill than are needed with any other type. Quick decision and great presence of mind are prerequisites due to the low flying altitude.

The advantages of the hanging glider are: easy dismountability, low weight and therefore limited size, whereby accommodation under the poorest storage conditions and transport to the flying grounds are possible with a minimum of expense.

Figure 6—Lilienthal hanging glider built for experiment. Displacement of body weight for control is observable.

The building of such a type plane cannot be recommended, for pure sailing flights cannot be made with it, and the low construction costs are more than offset by the disadvantages mentioned above.

(This is the first of a series of articles by Alfried Gymnich, which will cover the design, construction and operation of sailplanes. The next article will appear in the next issue of POPULAR AVIATION.)

What's Doing in Washington

WITH 20 air mail routes in operation and others in contemplation, plans of the Post Office Department for an airway postal service are now taking definite shape.

The first Airway Postal Service, said the statement of the Postmaster General, probably will be inaugurated on the trans-continental route between New York and San Francisco. Postal clerks will travel in the planes and "work" the mail en route.

Mr. New stated also that with the completion of the temporary lighting system between Dayton and Cleveland, O., air mail service will be established on August 1 on the Louisville-Cleveland route.

This will speed up service on the lines, because the mail can be carried directly to the airport and the clerk on the plane can sort it, thereby saving the time which would be used if the mail post office was obliged to separate it.

The new air mail postage rate, which went into effect August 1, will be applicable to articles in the regular mails posted in this country and addressed for delivery in Canada, and vice versa, the Second Assistant Postmaster General, W. Irving Glover, has just announced.

The postage rates for such service will be 5 cents for first ounce or fraction thereof and 10 cents for each additional ounce or fraction. The said postage rate includes the air mail fee and articles prepaid at that rate will be dispatched by air service in Canada, where available, as well as this country.

Captain Emory S. Land, Assistant Chief of the Bureau of Aeronautics, is to be detailed temporarily for duty with the Guggenheim Fund for the Promotion of Aeronautics, the Acting Secretary of the Navy announced recently. He will become technical advisor to the Foundation and will take over his new duties not later than September 1 for a period of a year. The duties of the technical advisor relate principally to the study and development of safety in aeronautics.

Tests of various damping liquids under all temperatures are being conducted by the Bureau of Standards to meet the requirements of modern aviation, according to an announcement made recently. The study seeks to discover the most suitable liquid for damping aircraft instruments. The explanation follows:

Damping instruments usually means immersing them in a liquid to lessen the effect of strong vibration. Many aircraft instruments of delicate construction are damped to overcome vibration from the motor, and the damping fluid is important in obtaining steady, accurate readings from such instruments regardless of wide and sudden temperature ranges in flight. It has been found by the Bureau of Standards that liquids with a small change in viscosity with temperature, also have values of viscosity which are too small for many purposes. The practice has been followed by mixing two liquids in such proportions so as to obtain the proper value of the viscosity but increasing with the rate of change in temperature.

Lighted mileage of mail airways total 7,698 on June 30, with 910 miles additional airways equipped with intermediate fields and markers for day flying. There remains 7,211 unlighted mail route-miles pending, under contract or actually operating. For the year ending June 30, 1929, the Department plans on lighting 4,000 of these.

Distribution of airplanes for use of reserve officers has been arranged by the Army Air Corps, when 123 will be available for use in June, 1929, as compared with the 92 training type of airplanes contracted for and delivered August 1st. This total is 13 more than the total called for under the approved five-year Air Corps program.

Invitations to attend an international conference on civil aeronautics to be held in Washington December 12, 13 and 14 have been issued by the Department of State to every country with which the United States has diplomatic relations. One delegate will be assigned from each country and he will present a paper on some phase of aeronautical development in his own country.

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PIONEERS - BOTH

E. A. Johnson, of the Johnson Flying Service, Inc., Dayton, Ohio, started in the airplane business way back in 1919. The same year saw the beginning of the Swallow Airplane Company at Wichita.

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What more natural than that these two Pioneers should join hands! Mr. Johnson is the representative in the Dayton trade territory for the Swallow, and is looking forward to 1928 as his biggest year by a wide margin. Certainly, in the Swallow, he is offering his trade a splendid value; a plane which will surely help him to accomplish his aims for this year.

Swallow offers three different types of motors as standard equipment—the old reliable OX-5 (of which we have a supply of new ones still on hand), the Wright Whirlwind, and the 150 H.P. Hispano-Suiza, illustrated above. Write or wire us for full details and dealer proposition. There are still some good territories available for the right men.

VICTOR H. ROOS, Genl. Mgr.

SWALLOW AIRPLANE CO.

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Aero Club News

ACCORDING to statistics furnished by the American Society for Promotion of Aviation, covering the first six months of 1928, there are now in existence over one thousand flying clubs. The main object of any flying club is to afford the members a means by which they can secure flying training at a cost within the reach of the pocketbook of the average individual. The government, however, has not given them the co-operation that is noted in Canada for example. There, after fifty members have been secured, a ship is furnished and for each pilot turned out, $100.00 is given to the club.

The main obstacle that any club meets is the purchasing of a ship. It is difficult, unless a large membership is available, to pay $3,500.00 or more for a plane. In consideration of the tremendous impetus which civilian flying is receiving through these organizations they should be given some sponsoring by our government. It is not too much to expect that, within the next two or three years, that there will be 50,000 persons in America who may be rated as solo pilots, and who have received their training through aero clubs.

Moorestown, N. J.

The Moorestown Community House, is the weekly rendezvous of the Burlington Country Aero Club. They offer ground and flying instruction to their members, and have four different classes of membership, each with a set of laws regarding payment for instruction, flight, or ship rental. All officers have been elected and a great deal of progress is already apparent.

Richmond, Staten Island

Some time ago we made the mistake of giving the Aero Club of Richmond's address as Richmond, Virginia, instead of Richmond, New York. Mr. Perricone, the President, wrote us and said: "How come you have us bawled up with that Jamaica outfit? The War is supposed to be over in the good old U. S. A." So, herewith we tender our apologies and congratulate the club for their good-natured attitude and witty President.

Newark, N. J.

The Newark Aeronautical Association, because of the extensive interest displayed in aviation throughout the Metropolitan area, was obliged to extend its scope beyond the limits of the city, and its membership today includes residents of Irvington, East Grange, Montclair, Belleville, and other nearby municipalities. Present officers for the organization are: Raymond E. Reise, president; Thomas Barwell, vice-president; David Walter, secretary; Michael F. Gates, treasurer. Uniforms have been purchased and much activity is forthcoming.

Frankfort, Indiana

The Frankfort, Indiana, Aero Club, Inc., has over 150 members, with half of them ready to take flying instructions. It possesses a long time lease on a 42 acre field, one mile south of the city and a hangar capable of housing six ships has been completed. The field is suitable for landing in any direction, the shortest runway being 1,000 feet. It is fully equipped with all conveniences and necessities for both plane and pilot. With such a splendid place from which to take their flying time, the members are expected to make rapid progress.

Norfolk, Virginia

The Norfolk Aviation Club has only been organized for three months but from the rapidity of its progress, it appears much older. The officers are as follows: P. L. Bryan, Jr.,

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president; R. C. Moser, vice-president; Earl White, secretary-treasurer; Wm. H. Harris, sergeant-at-arms. Many interesting events are planned and more news is on the way.

La Crosse, Wisconsin

The Winnesheik Flying Club has been making rapid strides since the beginning of its daily schedule a few months ago. An OX-5 Waco 10 is being used in the instruction work with a second Waco ordered and undoubtedly delivered by this time. Most of the members in the flying class have soloed with several more ready to solo. A girl of 19 years is also a member and if the boys do not "hurry up" she will pass them in flying. Every one is working hard and from their reports they are surely a progressive organization.

Chicago, Illinois

The plans to organize the Co-operative Flying Club, have been realized, and at the present time this club has many activities in prospect. A Travel Air OX-5 job has been purchased and George Myers, of Maywood, together with E. Hamilton Lee, of Forest Park, have been engaged as instructors. They have given many of the students flying instruction and will complete their courses with cross-country hops and night flying. The flying headquarters are at Checkerboard and Maywood Government field. The club, which is incorporated under the laws of the state of Illinois, has for its officers: Albert C. Ball, president; Henry G. Cleave, vice-president; Albert Lindahl, secretary-treasurer.

Danbury, Conn.

The Danbury Aero Club because of its scope has also been obliged to take members from Bethel, Redding, Brookfield, New Milford, Newton, Rawling and surrounding vicinities. The officers are as follows: Berkeley H. Hill, president; Arthur Graef, vice-president; Curtis Wilson, recording secretary; Joseph Platt, financial secretary; G. I. Gammie, corresponding secretary; Henry H. Taylor, treasurer. As soon as a plane is purchased the members expect to get their flying time.

Mason City, Iowa

The North Iowa Aero Club, organized early in the year recently has purchased a plane in which its members are now taking actual flying instruction. The personnel of the club is composed, to a great extent, of ex-service men who, under the leadership of Harold W. Vogel, have established a unit that bids fair to increase very rapidly as the year goes on. The following are the officers of the club: President, Harold W. Vogel; vice-president, J. Emerson Decker; recording secretary, Fred W. Bruns; financial secretary, Robert V. Ikenberry; corresponding secretary, James C. Trindle; treasurer, Karl P. Johannsen.

Montreal, Que.

A light airplane club has been organized in this community and the use of two government Moth planes have been secured. A residence belonging to an aviation enthusiast, N. A. Meyer, of Granby, has been donated to them for use as a club house. An airdrome has been prepared which is three-quarters of a mile long and a half mile wide, and a hangar large enough to house four Moth planes has been constructed. Joseph Gregoire is president; Capt. Carl Stohn, vice-president, and P. H. Boivin, secretary. Capt. F. N. Nase, of St. John, N. B., has been engaged as chief instructor to the club.

Baltimore, Maryland

Owing to press of personal business, W. F. Peck has resigned as president of the Baltimore Aero Club of Baltimore, Md. C. A. McGinnis has been elected president in his place. The club has twenty members taking flying instruction at the Park Heights Flying School of Baltimore, who have co-operated with the Baltimore Aero Club by reducing their rates for club members. The club recently created an additional class of membership, known as an Associate membership, with an initiation fee of $10 and the regular dues of $12 per year. This membership includes a complete ground course but no flying instruction and was introduced for the purpose of giving instruction to those who wish to enter the aviation industry in some one of its numerous branches other than flying. The present officers of the Baltimore Aero Club, are as follows: President, C. A. McGinnis; Vice-President, W. S. Hull; Secretary, G. L. Hain; Treasurer, L. B. Cronhardt. The club, which meets at 919 Harlem Avenue, Baltimore, will be glad to hear from others in and about Baltimore who would like to associate with this organization .

Perth Amboy, N. J.

Wm. Totin, secretary of the Perth Amboy Aero Club, Perth Amboy, N. J., advises that the club is well under way and shortly expects its charter from the State of New Jersey. The club is interested in purchasing an old OX, Anzani or some other aircraft motor on which the members could take practical engine instruction.

Beverly, Mass.

Philip R. Grush, president of the Beverly Aero Club, 69 Essex Street, Beverly, Mass., advises that the opening of the Beverly Airport was held early this month, but owing to adverse weather conditions the opening was not as successful as its sponsors had tried to make it. There has been considerable activity on the field since its opening and the Beverly Aero Club hopes to have its own plane working from the field within the next month.

Hollister, Cal.

Roy Slater of Hollister, Cal., is active in organizing the Hollister Aero Club. The plans at present are to enroll 25 members at $200 each. One of the members will be chosen to be sent to a good flying school to receive instruction and 50 hours of solo. The club then will purchase a new plane for approximately $3,000 and the student sent to the flying school will be allowed to use this to complete his 200 hours to get his transport license, after which he will give instructions to the club members to repay them for his training. This is the general outline of the plan as presented by a number of the members. Mr. Slater states that the plan is open to changes and would like to hear from other clubs who have worked along similar lines.

Herkimer, N. Y.

The Iroquois Aero Club of Upper New York State, which was organized recently by M. A. Knights of Herkimer, N. Y., reports splendid progress. Weekly meetings for ground instruction are being held and a number of sites are under consideration for airport development. The business men of Herkimer and surrounding communities are deeply interested in the work of this club.

Minneapolis, Minn.

The A. S. P. A. unit organized in Minneapolis by Willard Green and associates has adopted the name "City o' Lakes Aero Club" and has elected the following officers: President, Harlan Bynell; Vice-President, John Wells; Recording Secretary, Willard Green; Treasurer, Edward Rouen.

(*Continued on page* 90)

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Problems of the College Aero Club

By N. L. Engelhardt, Jr.

President, Yale Aeronautical Society

THE establishment of college aero clubs in practically every university of importance has created great enthusiasm during the past year in this new field of aeronautics. We have recently been confronted with numerous air races sponsored by industrial leaders and aeronautical organizations for the purpose of creating a better program of intercollegiate activities. With such developments confronting the future leaders of aviation, it would seem that some definite action should be taken to assure ourselves that we are moving along in the best and safest manner possible.

College aero clubs above all should represent the university from which they come. They should be recognized by the university authorities as undergraduate organizations in good standing, and receiving the backing of the university. They should be recognized not as a mere social club but as an organization equal in importance to athletic teams, literary and dramatic organizations.

It should be understood that the aero club is for the purpose of promoting aeronautics in its college. A report of its activities should be an indication of the manner in which its university is accepting aeronautics. Its activities should be conducted in the interest of the promotion of aeronautical science, and such a club should not be merely a private organization representing the interest of a limited few or perhaps a commercial enterprise. Both for the good of the university and for the interest and co-operation of the aeronautical industry a definite standard of organization must be established for these clubs.

Intercollegiate activities in aviation should be accompanied by a guarantee from the university that all is fair and amateur in the club. It could hardly be conceived that a professional pilot could be allowed to enter an intercollegiate air race any more than it would be permitted for a professional football player in football. Furthermore, flying is an extremely expensive game at present, and before a man enters any race it would seem advisable to make sure that he had had enough training and was sufficiently qualified. There can be no such guarantees under the present system of organization, and as a result it is not safe and sane. Imagine what would happen if a student was killed in an air race today, a not improbable situation. It would be a practically foregone conclusion that flying would be forbidden at that university thereafter. Look what happened at Princeton! And not only would flying be forbidden, but antagonism would be created by the authorities toward aviation matters in general, something which aviation cannot afford at this stage of the game.

The universities must be ready to back intercollegiate aviation activities before we can be assured of the success of any such activities. When we are assured of their co-operation, it would be possible to conceive that eventually they will be ready to assist financially in making this new sport a success. They will finance teams in air races just as today they finance teams in football and other sports and activities. They could even go so far as to make sure that the pilots on their teams are trained under good instructors, assuring the sponsors of the race that their men know their jobs.

Aeronautics offers such a wide field of activity that it would appear with proper organization other forms of intercollegiate activity can be found besides air racing. Perhaps something less expensive, something less hazardous, something which any college student can enter. We have seen glider contests in Europe held with huge success. Gliders form an excellent basis for the study of aviation and the development of airplane design. Why not hold an American Intercollegiate Gliding Contest? Furthermore, universities have large resources for research, collection and distribution of information and study. Clubs might institute research in such problems as safety, costs of operation, operation, proper use of airplanes in private flying, streamlining planes for racing purposes, best systems of flight instruction, motor design, airports and airways, translation of foreign papers on aeronautics, lighting. They might institute services such as photographic, distribution of information on their home fields, their organization, the flight operations, and many other subjects which would be of benefit to the industry and their brother clubs. Such work offers excellent possibilities for the outlet of the enthusiasm for aeronautics in the colleges, and beyond that it is bound to be of value to aviation and to those men who intend to make aviation a life work. It will produce good leaders.

There are many clubs which are formed or which are being formed merely because it is apparently what is being done. They have no definite purpose, they have no definite plan for the future. They request information on the activities of other clubs because they do not know what to do with themselves. And that is exactly the problem which must be faced. A definite program of the activities of college clubs must be established or we will be doomed to failure. The universities must be made to realize the importance of their existence and the benefits which can be derived by the students who participate in their program. It appears without doubt that the consideration of practically every aero club is being turned toward the production of pilots as well as racing. This problem alone is of tremendous importance. It requires money and great skill to train a good pilot, and by a good pilot I mean one who has had something over one hundred and fifty to two hundred hours in the air. How many students in our colleges today can afford to take two hundred hours of flying at something like $25 per hour? Certainly not very many, and those who can are not in general concerned with the promotion of aeronautical science, but are in the game for a sporting proposition, perhaps a good way to spend money.

What the colleges need today is a complete understanding of the activities of aero clubs. Organization of the clubs and the co-operation of the industry will be the prime movers in establishing this relatively new field of aeronautics.

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The Sick May Fly

By Willis Parker

"Bob" Rhea, who made the 3,617 mile trip by air.

THAT airplane travel is not only safe but practical for those in ill-health is proven by the recently completed 3,617 mile air jaunt of Robert Rhea of Colorado Springs, Colo., in an open cock-pit Eaglerock plane, equipped with a 90-horse power motor—a ship that had seen hard service at the Pikes Peak Flying School. The plane was piloted for the most part by Captain Earl H. Zimmerman, instructor at the school. Mr. Rhea has a private pilot's license and on some of the good flying days he could take the stick for a while, but the condition of his health would not permit it for long.

Since May, 1920, Mr. Rhea has been confined to bed practically all the time due to a disability incurred while he was in the army in 1918, and the only trip he had during that time, outside of Colorado Springs, was a trip east three years ago in the care of a physician in an effort to find some surgeon who could promise some relief from his disability —tuberculous empyema. That long trip in Pullman cars started him on the down-grade again, but in the summer of 1926 he was able to be up an hour or two each week,, and by the fall of 1927 his activity had increased to the extent of being able to walk around the block about every second day.

An open wound in his left side made it painful for him to travel in a train or in an automobile. Late in the fall of 1927 he became interested in a flying school in the Springs and actually took some flights, though they lasted but a few minutes at a time. He found that in an airplane he could travel in comfort. Then he wanted more flying and conceived the idea that he might take a long trip—by easy stages—and see some of his old friends and relatives in other states.

The school was closed in February for two months. Rhea purchased one of the planes and hired Captain Zimmerman to go with him on the trip which should last as long as Rhea was physically able to stand the strain. As Mr. Rhea says, "We made no particular plans except that we would, if I found it desirable, try to visit as many of my old friends as possible and cover by air a lot of country where I had found the most pleasure during the healthy portion of my life."

The ship was overhauled and made ready for the trip. Rhea made extensive preparations for his own comfort and health and besides constructed the flight maps and other data required. Considering Rhea's preparations for his own comfort and health, he declared that owing to the large amount of surgical supplies he had to have with him, there was no room in his suit case for many clothes so that his wearing apparel was confined to the clothes he wore, with only a couple of extra shirts. All of his Colorado Springs friends and the doctors thought the flight was suicidal for him, but he was determined to make the experiment.

Considering the stern disapproval of friends and doctors and the dire prophecies they made, their experiences on the first day would cause many a stronger man to turn back and abandon the venture.

On the promise of fair weather February 9 to El Paso, Rhea and Zimmerman shoved off from Colorado Springs at 7:55 a. m. Passing over Pueblo—45 miles from Colorado Springs—they could see heavy clouds commencing to pile up over Raton Pass, some 80 miles ahead and they realized the storm was moving north towards them.

"It began to be bitterly cold," explained Mr. Rhea, "and in a very short time puffy clouds were slapping us in the face and we began to be very uncomfortable. The altimeter was registering 11,000 feet and we were climbing steadily in an effort to get over the heavy clouds that increased as we proceeded. When nearing Raton Pass, where the mountains were as high as 10,000 feet or more we succeeded in getting above the clouds for a while. If the engine had cut out about this time, or any time during the next hour, it would have been too bad, because nothing at all could be seen under us."

When, according to their time schedule, they should have been over Raton Pass the pilot began easing down through the clouds. There was no way of telling exactly where they were, for if they had been bucking a heavy north wind they might be north of the mountains instead of south. It was a thrilling time, no doubt. However, they got down through the clouds and saw ground about 300 feet below them. Then it began to snow. The time schedule indicated that they should be nearing Las Vegas—they were 13 minutes behind the schedule when they sighted the town. But the snow got worse and the clouds lowered until they were but a short distance above

the house tops. Then they sought a landing place. It took 20 minutes to find what seemed like a suitable place, but the ground was covered with 8 inches of snow, and they couldn't determine the irregularities of the ground. Just about the time they decided to go on, they spied a likely landing place and set down. It was snowing so hard that it was impossible to see 100 yards ahead.

"As the plane came to rest," explained Mr. Rhea, "Zimmerman climbed out and walked ahead, kicking along the ground feeling for ditches, while I taxied the ship along behind until we came to a fence to tie down to. We noticed a man walking towards us through an orchard. As he approached the ship he said, 'I have been following you fellows for half an hour,' and we looked up and saw him crumpled up against the fence, then falling to the ground. When we got out of the ship we found that he was dead, and it appeared that he was a Mr. Howe, who was hoping to sell us some oil and gas. All of this happening within four hours after leaving Colorado Springs did not make a very pleasant beginning for a pleasure trip."

I mention this experience merely to show that even an invalid can survive an airplane trip where weather conditions make flying a rather trying proposition. When they took off from Las Vegas, after staying an extra day to attend the coroner's inquest, it was bitterly cold. Mr. Rhea's vitality is necessarily low, owing to his physical condition, yet he withstood weather and temperatures that would have worried many a well man.

Almost every kind of weather imaginable was encountered on the journey, further proving the practicability of airplane travel for invalids. The last half hour of travel before reaching El Paso was worse than that encountered at Las Vegas —snow, rain and sleet pounded them. When they landed at Fort Bliss, officials in charge of the landing field would not believe they had flown through that sort of weather.

Short hops and long rests were part of Rhea's schedule. Therefore he stayed several days in El Paso, spending most of the time in bed at the hotel where friends and relatives came to visit him.

Five days after leaving Colorado Springs, the couple left El Paso, Tex. with San Antonio as the day's destination and with Dryden scheduled as the first stop for gas and oil. It was below freezing when they left El Paso, but the sun soon warmed things up and flying was more of a pleasure.

"During the afternoon when the sun got real warm, I went sound asleep," Mr. Rhea admitted. "There is no trouble keeping awake when it is cold, but with the warm sun on your head and the steady drum of a beautifully running motor in your ears, it is mighty difficult to stay awake. I think this was the first time since 1920 that I ever went to sleep without making a lot of preparations for the event."

Mr. Rhea is accustomed to taking two hours sleep every afternoon, so he didn't miss it this day.

"We holed up at Gunter Hotel that night and I ate the first meal I have relished in eight years. Also, I didn't need anybody to rock me to sleep."

Leaving San Antonio after two days' rest, they headed for New Orleans, against the advice of a pilot who arrived at the field just before they pulled out. He told them the air was the roughest he had experienced in 8 years flying. They took off, however, and, while the air was so rough that Rhea had the first symptoms of air sickness that he had ever experienced, they did enjoy the scenery. Because of the head winds they were unable to make the progress desired so sat down at Lake Charles for the night. They landed

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in a rice field which they mistook for an airport. That night a near cyclone arose, and, had the ship not been drawn up behind a couple of bill boards, it probably would have been demolished.

Nice weather and a tail wind brought them into New Orleans a little ahead of schedule. They intended to stay in the southern city two days, but they arrived just at the time of the Mardi Gras so they delayed their departure so that Zimmerman might take in that event. Rhea spent his entire time in bed, with the exception of one day when he saw one of the parades and took a ride around the city. Bad weather —heavy rains—caused them to stay in New Orleans eight days. Had they been able to follow their schedule, they would have gone on to Florida and then up the Atlantic coast. Rhea felt that this part of the trip would have to be abandoned, now, and that it was undesirable for him to be away from certain medical treatments which he could obtain only at home. So after leaving New Orleans, they headed for Montgomery, Alabama. The smoke from Birmingham industrial plants was drifting towards them on this day's journey and it irritated Rhea's lung to such an extent that he coughed all the way. They had intended to stop at Montgomery for gas, but they finally determined to stay there for the night. In that one hop, they flew over parts of Louisiana, Mississippi, Florida and Alabama.

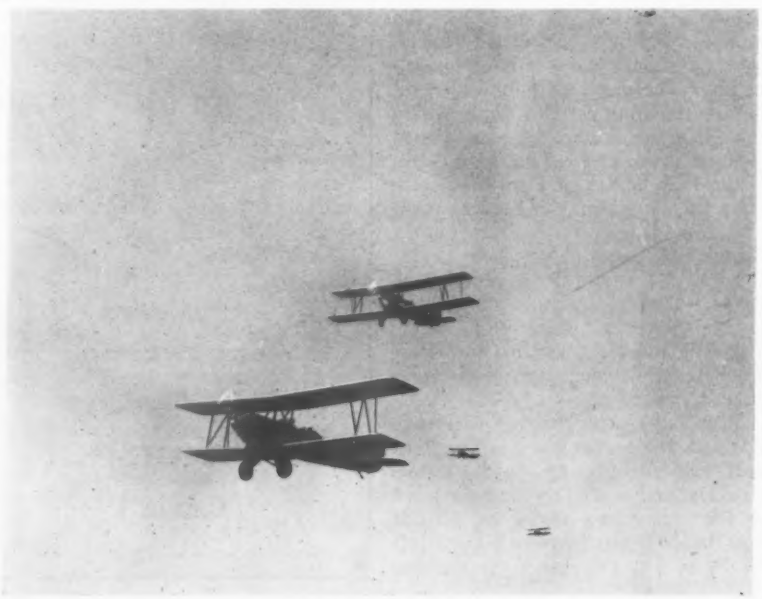
The following day, February 27th, they hit out for Nashville, which is Rhea's old home. Approaching Birmingham, breathing was more and more difficult for the traveller, who coughed incessantly. After passing Birmingham, however, there was no more smoke and Rhea had an opportunity to view again his old haunts—places where he had hunted quail and duck when a boy, the rivers on which he had sailed many, many times. Imagine the enjoyment of seeing all of those places from the air!

At Nashville, relatives met him, but Rhea insisted upon taking a room at the hotel instead of at the home of a relative because he wanted rest —not entertainment. However, friends sought him out, and to get rest he had to climb into an autmobile and ride about town—slowly of course. The entire trip thus far had not tired him as much as a fifty mile automobile trip would have.

After visiting his friends and relatives—giving them two days of his time—Rhea and his companion took off for St. Louis. The weather began to look bad about the time they had reached Eddyville, Kentucky, and when they had travelled 130 miles from Nashville, things looked worse. As they flew over Herrin, Ill., the clouds forced them close to the ground and shortly they were in heavy snow.

"It looked pretty bad," he says, "but we thought we could make it into St. Louis, but suddenly the whole Heavens turned loose in a solid drift of snow and we took to the ground in a hurry. We found we were down in a thirty acre, muddy field, in deep snow, nine miles north of Chester, Ill., and an accommodating farmer took charge of us. We did not know that this was in the country that is still upset by the Herrin trouble and until later in the day we were unaware that the countryside suspected us of being some sort of officers prying into their affairs. A

Rhea being escorted by friends on his return to Colorado Springs.



decided animosity, however, could be felt in their attitude, with the exception of the one farmer who appeared friendly. Several Winchester rifles were apparent in the crowd that rallied around.

"It took me an hour, in my heavy flying suit, to walk to the farm house one-half mile away."

Inquiry showed that this was no country for automobiles, either, but the farmer agreed to hitch two heavy horses to a light buckboard and attempt to get them to the concrete road. Had it not been for a friendly ex-artillery officer passing by in an automobile they would have had to wait for two hours in the storm in the bus. He took them into St. Louis, 56 miles away, though the snow was blinding in its intensity. There the travellers spent two days, while Rhea attended to some business matters and Zimmerman got the plane out of the field and to St. Louis.

Leaving St. Louis, they had nice sailing to Kansas City where they gassed up and lunched and took off again for Colorado Springs. They had an even break with the wind. It looked as if they could make home by night, so at a little town in western Kansas where they stopped for fuel, they sent a message home announcing the hour of their arrival. But they didn't arrive on schedule. A snow storm was doing its duty by the dry farmers of eastern Colorado and after hedge hopping and otherwise flying low, they gave it up, turned tail and flew back to the first town they could find. They made Colorado Springs the next morning, however, arriving at the field in an hour.

The above incidents are related largely to indicate the experiences that even an invalid can withstand in air travel. The trip required but 45 hours and 55 minutes air travel—easy travel at that because of the lack of jarring. It would have required 143 hours of rail travel and the total expense for the trip was 7.6 cents a mile for each of them and included hotel bills, meals, oil, gas, taxi fares—in fact every thing.

No ill effects were felt by Mr. Rhea after his return home and retired again to his bed. He is enthusiastic and believes that others as seriously incapacitated as he and no better off financially could afford and would obtain much pleasure from airplane travel which he insists is not a rich man's game only. It is not as expensive as automobile travel and not any more dangerous.

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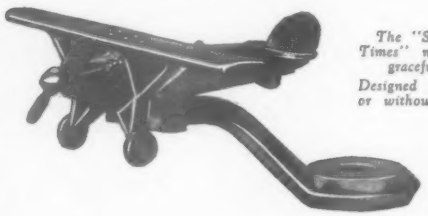

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"ABOVE THE CLOUDS" *Ash Tray* Here the "Spirit of the Times" is mounted on a serviceable ash tray of graceful proportions. The tray is finished in hand-hammered stipple effect. It is highly ornamental and a practical utility as well. **Price postpaid $1.50.**

"SOLITUDE" *Book ends* It would be difficult to imagine a more appropriate graduation, holiday or birthday gift. **Price, pair, postpaid $5.00.**

ANCIENT ART METAL CO., Inc., 84-86 Withers St.
Specializing in Novelties for the Promotion of Aviation
BROOKLYN, N. Y.

National Air Tour

(*Continued from page* 38)

gratulated upon the success of their carefully laid plans.

The manner in which the route was laid is interesting to note. Mr. Cooper personally made a tour, covering the states through which the flyers would come, and selected the best ports available. To do this required a great deal of work, as each town thought its field was the best available. Many, however, had "big ideas," so to speak, and were crossed from the list. The committee, and Mr. Collins, the referee, spent weeks preparing the rules, regulations and itinerary; corresponding with the various towns listed to make sure that all necessary preparations were made.

Every city or town was requested to send a layout of their airport with obstructions indicated, relation of port to town, the surrounding railroad lines, etc. The field was to be marked with a white circle, 100 feet in diameter, with a dot ten feet in diameter in the center. The time of arrival was to be checked by official timers, placed on the side of the field at either end of the finish line. The plane flew over this line to prevent accidents which might occur should a number of planes try to land simultaneously. Personnel for the field, including referees, judges, etc., were to be selected by the city for their respective positions.

Wind cones were to be placed on two opposite sides of the landing field in order to give the pilots direction of the wind, and for purposes of visibility, white wind cones were chosen. The committee also requested smoke smudge fires, for they are excellent field markers and wind direction indicators.

The field equipment in the form of ropes, stakes and strainers were to be carried by each contestant. Mechanics were furnished the incoming flyers, and if they remained throughout the night, adequate transportation to the city was also requested.

The checkers inspected the load carried by each plane and compared it with the one required in the log book. The planes were loaded in accordance with the power used.

Each log book was carefully marked with time of entry, gallons of gas placed in the ship, number of miles traveled, and, as mentioned the weight carried.

(*Continued on page* 80)

MEYROWITZ LUXOR GOGGLES

MEYROWITZ LUXOR GOGGLE
U.S. Air Service Model No.6

Price $10.75 in Aluminum Pocket Case

The most scientific eye protection ever developed for aviators

For years . . . . ever since goggles were used for eye protection in the wind stream of fast travel, Meyrowitz has been developing and improving the goggles which bear the famous Luxor trademark. From the early days of motorcycle and automobile racing up to the present day of unbelievable speed on the ground, over the water or in the air, the requirements of complete eye protection with perfect vision and thorough comfort have been met in the continuous improvements made in Meyrowitz Luxor Goggles.

Today in the field of aviation Meyrowitz Luxor Goggles stand pre-eminent in the choice of aviators who demand the best in equipment. Every single factor of perfect performance has been considered in their design. The precision of the highest grade optical goods goes into their manufacture. No more care is used in building a high powered microscope. The knowledge gained through years of experience devoted to the improvement, correction and safety of the human eye guides every development.

More aviators fly with them than any other goggle made.

If you have any difficulty in getting genuine Meyrowitz Luxor Goggles write us direct. They are on sale at airports, sporting goods and optical stores, aircraft dealers and flying schools.

LUXOR

Prices

U. S. Air Service No. 6
(Illustrated)

With white cylindrical bent lenses	$10.75
With tinted cylindrical bent lenses	12.75
With white hand ground meniscus lenses	15.00
With tinted hand ground meniscus lenses	16.50

U. S. Air Service No. 7
With clutch type bridge and double lip cushions

With white cylindrical bent lenses	13.75
With tinted cylindrical bent lenses	15.75
With white hand ground meniscus lenses	18.00
With tinted hand ground meniscus lenses	19.50
With white hand ground cylindrical lenses, U. S. Army specification No. 3024	20.00

Regular Model 6

With white cylindrical bent lenses	9.75

Luxor Model 5

With white cylindrical bent lenses	7.50

Tinted Lenses

Amber, euphos (green) or smoke tinted lenses, also special lenses accurately ground to perscription can be fitted in any model.

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520 Fifth Avenue, Dept. P., New York

Minneapolis St. Paul Detroit London Paris

Please mention Popular Aviation when writing to advertisers

The planes were started one minute apart and in case of mechanical difficulties which made it necessary for the pilot to remain at the field, the checkers on the field had nothing further to do about the matter, as the pilot was only using up his flying time to the next port and hurting his chances of winning.

The itinerary was as follows:

Town	Date
Indianapolis	June 30
St. Louis	June 30-July 2
Springfield, Mo.	July 2
Wichita, Kans.	July 2-3
Tulsa, Okla.	July 3-5
Fort Worth, Texas.	July 5-7
Waco, Texas	July 7
San Antonio, Texas.	July 7-9
Marfa, Texas	July 9
El Paso, Texas	July 9-10
Tucson, Ariz.	July 10-11
Yuma, Ariz.	July 11
San Diego, Cal.	July 11-12
Los Angeles, Cal.	July 12-14
San Francisco, Cal.	July 14
Fresno, Cal.	July 14-16
Corning, Cal.	July 16
Medford, Ore.	July 16
Portland, Ore.	July 16-18
*Tacoma, Wash.	July 18-19
Spokane, Wash.	July 19-21
Missoula, Mont.	July 21
Great Falls, Mont.	July 21-22
Froid, Mont.	July 22
Minot, N. D.	July 22-23
Fargo, N. D.	July 23
St. Paul, Minneapolis.	July 23-25
Wausau, Wis.	July 25-26
Milwaukee, Wis.	July 26-27
Chicago, Ill.	July 27-28
Battle Creek, Mich.	July 28
Detroit, Mich.	July 28

*Unsettled weather caused a slight change of schedule, making it necessary for the flyers to stop at Vancouver on the Tacoma-Spokane route.

This tour, which is commonly called the reliability tour, is important to aviation in that it demonstrates the feasibility of making a national journey in stock planes. The stops are adjusted to the importance of the various centers, and from the interest displayed in every city and town, the tour was worth while from a standpoint of publicity.

John Wood, flying a Waco ten, led the field at the completion of every leg, with Frank Hawks, piloting a Ford tri-motor a close second until they reached the West Coast, when Wood had attained a lead of more than a thousand points. It is interesting to note that out of the twenty-five that started, twenty-four landed at Detroit at the completion of the tour. This certainly speaks for reliability, for outside of a small amount of engine trouble, the hops proceeded with clocklike regularity and every town was reached on scheduled time.

Some poor flying weather was encountered on the San Francisco to Corning leg, as fog enveloped the field and surrounding territory. But, even with this hindrance, every one with the exception of three had a perfect score. When they hopped for Medford from Corning, mountains 4,000 to 7,000 feet high faced them and the sight viewed from the referee's plane was one which is unusual, as huge mountain crests, enveloped in clouds, with planes winging their way across were seen.

At 2:00 P. M., July 28th, the last day of the flight, they left Battle Creek for Detroit, and Wood was conceded the prize unless something serious occurred. At 2:52, however, on the same day, as the planes dropped into the Ford Airport he was still in the lead by over 3,000 points. The list of the planes with their respective pilots and the place won may be found on page 38.

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AERIAL NAVIGATOR

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A marked shortage of planes exists today due to a lack of skilled mechanics and designers to construct and repair.

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Department PA8

AVIATION SERVICE *and* TRANSPORT, Inc.

203 N. Wabash Ave., Chicago

AN AIRPLANE FREE

ENROLL your name with us! Become a member of America's Greatest Air Society and help **"Make America Supreme in the Air!"**

Already The ASPA has organized over 400 civilian flying clubs throughout the United States. But we need more. Many more. And we need **you!** Helping to carry on this work in your community!

For The American Society for Promotion of Aviation will petition Congress to appropriate $40,000,000 to supply **gratis** airplanes to every organized aero club of fifty members or more.

In doing this, we are simply urging Congress to follow, without delay, in the footsteps of the Canadian Government, which supplies an airplane **gratis** to every civilian flying club. In fact, Canada goes further than this—for Canada pays each club $100 for every pilot turned out.

$40,000,000 Jokes

$40,000,000 will provide 10,000 modern airplanes for training purposes. This is less than the cost of a first class battleship. And as an editorial in one of America's greatest newspapers recently pointed out—battleships are fast becoming a joke. *What this country needs, and hasn't got, is the world's best fighting AIR Fleet.*

What the ASPA *Is*

The American Society for Promotion of Aviation was organized by 12 ex-service aviators at the Army & Navy Club, New York City, in 1925. It is a voluntary non-profit organization incorporated, and maintained

To "Arouse and promote interest in aviation, as our strongest army of National Defense."

To make America air-minded—to cooperate with air-craft manufacturers in building up this newest industry—

To organize civilian flying clubs throughout this country and to help train pilots for national emergencies.

Join Aviation's Great Fraternity

Enroll Now, *Become a member of ASPA* and as our representative work for aviation in your community.

Membership fee

ONE DOLLAR

which covers the cost of silver wings, membership card and literature of The American Society for Promotion of Aviation.

Write for information as to how you may organize an aero club in your community

Secretary, ASPA
522 Fifth Avenue
N. Y. City

Silver Wings Actual Size

Yes I am interested, and I want to add my name to the thousands already enrolled by you in your petition to Congress to provide funds to furnish airplanes gratis for civilian flying clubs, organized under the auspices of the ASPA or other accredited aviation organizations. Dept.PA

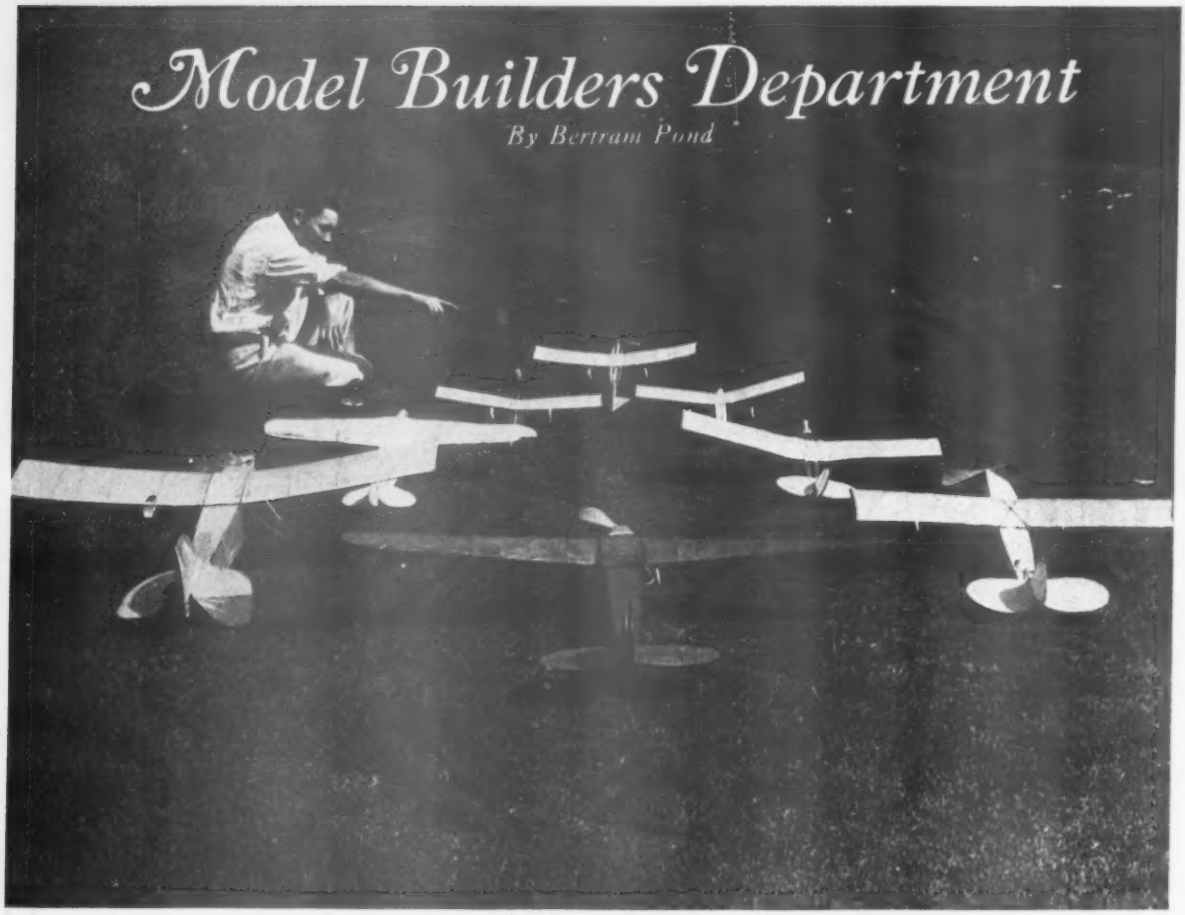
Name.....

Address.....

City..... State.....

Model Builders Department

By Bertram Pond



The "C" Model

HERE is a dandy little model and why do we print it here? There are a number of reasons as follows:

The record style outdoor machines are long, awkward to handle and frail. It is very discouraging to build a fine record style model and break it up on the trial flight or even on the way to make a trial. (Suitable fields are seldom near home.) It takes an athlete to follow one, or an automobile can be bounced over fields after them if you wish. A very large field is required if the model is to be found. Landing in trees and on house tops spoils the fun.

It takes time and workmanship to produce these record types. Flying them is another trick too! Boys under fourteen years have trouble with building record types at all.

A slightly smaller and sturdier model with sure flying qualities can furnish much more enjoyment and is as instructive to work with as the record types.

The Culver School of Woodcraft, conducted under the auspices of the Culver Military Academy selected this model for instructing in model building and this, alone, is a good recommendation for the model as well as the course available at the Culver School of Woodcraft.

The tapered wings of the Hawk combined with the simple elevator and the general ease of construction make this peppy model a pleasure to build and fly. It will loop, climb and speed for sixty seconds, and more. It will make a fine model for the older model fliers to play with.

Balsa parts used for making the "C" model should be smoothly and accurately cut from high grade light wood. Chinese Tonkin bamboo is best for bamboo parts.

Let us start right in and build this model step by step.

Parts List

First you will need the following materials for your lively "C":

2—$\frac{5}{32}$"x$\frac{3}{8}$"x30" Motor bases.
4—$\frac{1}{8}$"x$\frac{1}{4}$"x11" Wing beams.
2—$\frac{5}{8}$"x1$\frac{1}{8}$"x8$\frac{1}{2}$" propeller blanks.
2—pieces $\frac{1}{16}$" balsa veneer for elevator tips.
1—Coil No. 10 music wire.
1—Coil No. 12 music wire.
2—Rubber motors $\frac{1}{8}$"x$\frac{1}{32}$"x18'.
1—6" Bamboo strip.
1—8" Bamboo strip.
1—10" Bamboo strip.
2—Bearings.
4—Washers.
1—Sheet Japanese tissue.
Ambroid.
Banana oil.
Light dope.

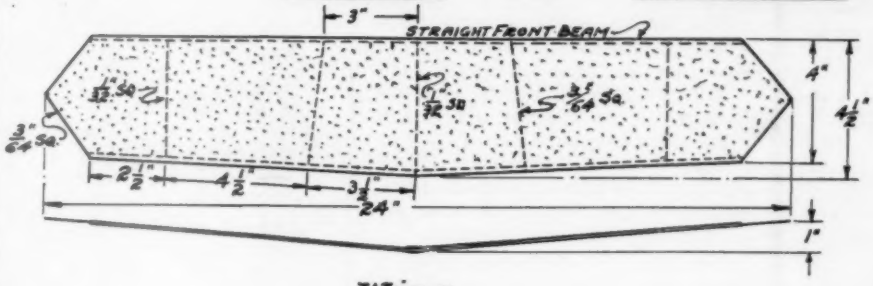
(Note: Keep ambroid and dopes sealed when not being used.)

Tools

The tools required are a knife, sandpaper (fine and coarse), a foot rule, pencil and camels hair brush. You will need a round nose pliers and a hard steel cutter pliers if you wish to make your own wire parts. Use the full size patterns at the foot of the sheet of drawings as patterns.

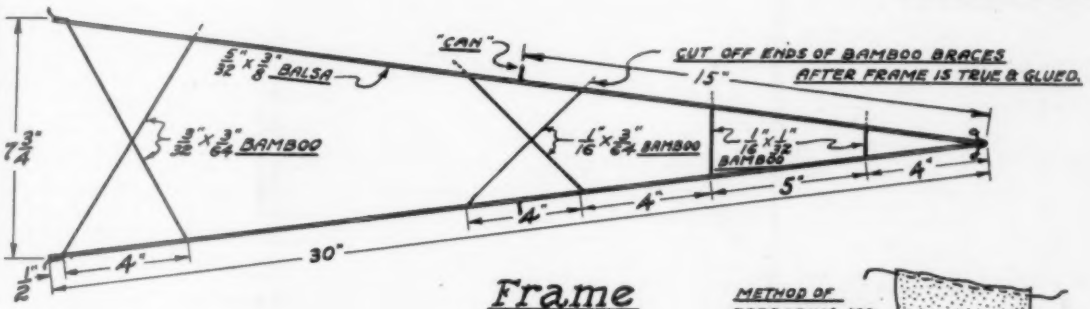
Look the drawings over carefully and reread the directions before

★ — THE C MODEL — ★



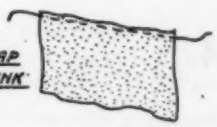
Wing.

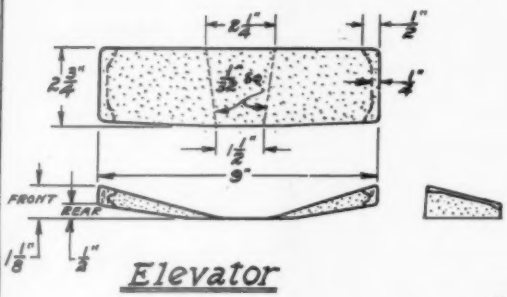
SMOOTH WRINKLES IN COVERING AS SHOWN.



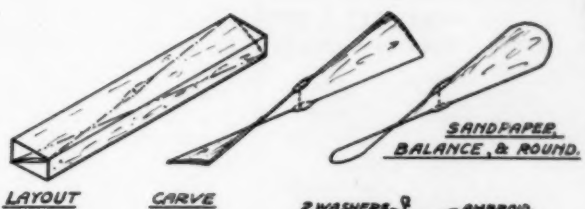
Frame

METHOD OF PREPARING JAP PAPER FOR SHRINK



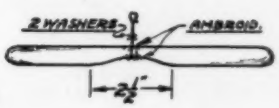


Elevator



Propellers

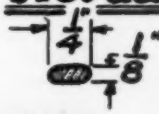
(MAKE ONE LEFT & ONE RIGHT)



Details – Actual size.

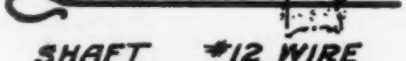
"CAN" #12 WIRE-2 REQ.

FRONT HOOK #12 WIRE



WING BEAM

"S" HOOK #12 WIRE 2 REQ'D.



SHAFT #12 WIRE 2-REQ'D.

ELEVATOR TIP.

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THE "C" MODEL described in this issue. Easy to build, carry and fly! Complete construction kit postpaid only $2.75 or with propellers already carved, $3.95.

LINDY'S SPIRIT OF ST. LOUIS—33-in. wing. Finished body sides and Clark curve ribs, hand carved and lacquered propeller with spinner, disc wheels, etc. Makes light flying model. Special price $5.90; or with parts unfinished, bargain, this month only, $2.50 postpaid with diagrams.

IMPROVED ELLIOTT SPECIAL—40-in. outdoor duration plane easily built. Complete kit including HYDRO EQUIPMENT! Postpaid special $4.00.

Do not be fooled by cheap imitations. Our kits are approved and licensed by the Model Editor.

RUBBER—fresh every week. ⅛-in. flat full skeins (about 200 feet) bargain price only $1.60, postpaid.

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Write for prices on compressed air and small gasoline motors.

SEND TEN CENTS (10c) FOR BIG NEW LIST IMMEDIATELY

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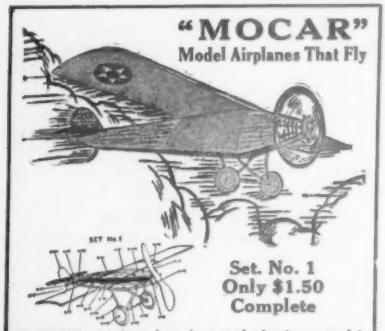

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The "Mocar" monoplane—Set. No. 1—is a copy of the famous Spirit of St. Louis. Wing Spread 18 in., fuselage 12 in., powerful motor, ball-bearing propeller, rubber-tired disc wheels. Weight complete only about 2½ oz.

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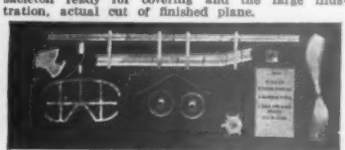
Great fun, learn how to make and fly airplanes. **Order now.**

Jobbers, dealers and schools write for net prices.

The illustration below shows set mounted complete for assembly. Small cut above shows all metal skeleton ready for covering and the large illustration, actual cut of finished plane.



The Mount Carmel Mfg. Co.
Dept. P. **Mount Carmel, Conn.**

starting in on the building, as it will be much simpler.

Frame

The frame requires very little work. Round the four edges of the spars evenly. (See drawing.)

With the rule and pencil, mark the location of the bamboo braces and cans on the beams.

Two coats of banana oil with a light sanding between will strengthen and smooth the surface, especially if spars are light weight balsa.

Cut one end of the sticks on a taper (see drawing) for the nose. Dip both ends in ambroid about an inch and let dry. Then Ambroid the sticks together on an angle so that the spars are 7¾" apart at the rear with the sticks straight. Let this dry well while you make the bamboo parts.

Splitting Bamboo

Remember, bamboo splits easily but you have to split in the center to make it split straight. When split to near the correct size, scrape the pieces to correct sizes and round the edges. DANGER: Bamboo is sharp on the edges and will cut the fingers in scraping if held in the fingers, so scrape on a table using a sharp knife.

Sharpen the ends of the bamboo pieces and insert them in knife slits in the spars at the correct marks you have made. Do not mistake the wire loop or "can" location mark for the bamboo mark. Let the bamboo come flush or smooth on one end with the outside face of one spar and extend through the other spar.

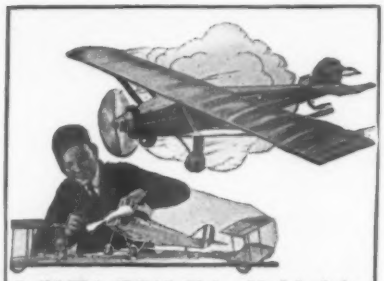
Alignment of Frame

Very carefully align the frame by sliding the extended ends of the bamboo until the spars are straight. Be sure to keep the 7¾" spacing at the rear of the spars (measured from outside to outside edges).

Ambroid the bamboo and spar joints carefully. Do not let the bamboo slip and spoil the alignment. Ambroid the X braces together at the center. When thoroughly dry, cut off the extended ends. This can be done easily by notching one side and splitting off the bamboo in several small slivers. Sand over this slightly and ambroid over all bamboo joints on the outside of the frame.

Fittings

Make the wire parts between times (when the cement is drying) to the actual size patterns on the drawing. Ambroid them in their correct places with two coats. Cement the bearings on with several



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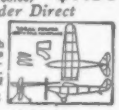

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	Spruce	Bass	Balsa
1/32"x1/16"x3'	.03		
1/32"x 1"x3'			.06
1/16"x1/16"x3'	.03		.033
1/16"x1/4"x3'	.045		.054
1/16"x3/8"x3'	.039		.045
1/16"x1/4"x3'	.048		.054
1/8"x1/4"x3'	.054		.06
1/8"x1/2"x3'		.099	.108
1/16"x1"x3'		.075	.084
1/16"x1"x3'		.09	.102
1/8"x 1"x3'			.24
1"x 3"x3'			.43
1"x 3"x3 1/2'			.50
1/4"x1/4"x3 1/2' Balsa I beams			.105
1/16"x1/2"x3 1/2' Balsa I beams			.123
1/16"x3/8"x3 1/2' Balsa I beams			.14
1/2"x 1/2"x3 1/2' Balsa I beams			.17

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Also propellers and Wing sections.

Ambroid dope, ¼ pint	.50
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Ambroid cement, 2 oz.	.33
Bamboo paper, 13"x36"	.12
Bamboo paper, 24⅜"x33⅜"	.14
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1/8" flat rubber, 50 feet	.75
1/32" Piano Wire, per coil	.15
28, 30, 32 Wire, per spool	.10
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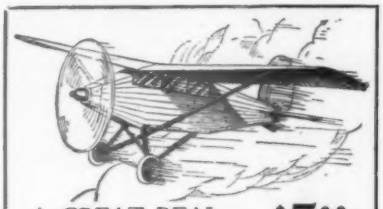

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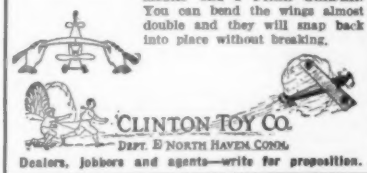

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coats of ambroid. Be sure you have a dry coat of ambroid under the bearings so they will not come loose. Do not forget that the ambroid can should be covered when not in use as it loses strength and dries up.

Propellers

Lay out the two blanks with your pencil and ruler with lines as shown on the drawing, making one opposite from the other. Carve the propellers down roughly until they are about $\frac{3}{32}$" thick at the ends and the same shape as Figure (2) on the drawing. *Do not round the ends* until you have carved and rough sanded to the square-end shape. Round the ends then only using a fifty cent piece or a compass or paper pattern to make them all alike. Finish sanding the blades to a little less than $\frac{1}{16}$" thick. The front face should be slightly rounded and the rear flat or slightly cupped. Check the propellers very carefully at this stage for balance. Lighten the heavy ends until they balance exactly at the center. If the hub is left a trifle thick (⅛" or more), the rear of the hub can be cut out as shown in the drawing, making a neat looking and light weight propeller.

Ambroid the hub all around so the shaft will not pull through the soft balsa. Two coats of banana oil with a very light sanding between should be applied. Insert the shafts (formed to pattern on drawing) very carefully, so that propeller will revolve true. The shafts will push through the soft balsa easily without any drilling. Bend a "U" in the end of the shaft and push it into the hub so as to drive the propeller positively. Ambroid the shafts in place securely. Then give the propellers a last fine balancing. Put two washers on each shaft with a minute drop of oil and the propellers are ready for flight.

Wing

Round the four wing beams off slightly (see drawing). A full size pattern of half a wing will help you to assemble the two halves. Make the halves as flat as possible. The front beam is straight and the rear beam is set tapered. Assemble the two halves by supporting the tips 1" above a flat table and Ambroid the joint. This can be a plain butt joint if several heavy coats of ambroid are used on both sides. Let the ambroid dry well with the wing tips supported.

Papering

Cut a piece of paper just a little larger than needed to cover the wing. Prepare the wing by coating the

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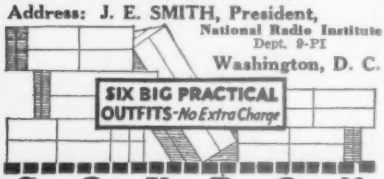

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beams with several coats of banana oil. Then banana oil the spars again just at the center and stick the paper in place. Then wet just a few inches at a time and stretch the paper outward. When all is stuck down, sand the excess paper off of the edges or cut off with a sharp razor blade.

The wing can be doped with a coat of very light dope, but if papered smoothly, do not dope the wing as one has to combat warping. (This can be done, however, by shrinking the paper first. Thread one edge of the paper on a string and shrink it by wetting it and then drying. It must be ironed to smooth the rough surface out.)

Elevator

The elevator is made of bamboo with balsa tips. It is easily made and assembled using plenty of ambroid. The only danger point to be careful about is getting enough bend or angle in the front beam to make the machine elevate and fly with stability. The rear beam should have considerable less angle than the front.

It is well to sand the tips down to 3/64" and give them a coat of banana oil.

Paper the elevator in the same manner you papered the wing.

Now you are about ready to take a trial "hop" and enjoy the speedy performance of the trim little ship.

Assembling the Units

Make a few "S" hooks and string up some 5, 6, and 7 strand motors. Make the motors with very little sag.

Slip the propellers into the bearings so that they turn up in the center. Fasten the elevator and wing in place with rubber bands and the model is ready to fly.

Flying

Here's the real sport and fun! You should have a winder to get best results. Start with about 100 turns of the winder for a trial flight.

Launch the model on an even keel *facing* the wind and watch it closely. If it noses to the ground, move the wing and elevator forward or if necessary, put more angle in the front elevator beam. If it loops and then flys in surges and stalls, move the wings back a bit. Then wind it up 200 turns on a winder (4 or 5 to 1) or even a little more.

You will get a real thrill out of this little ship.

It is well to fly your ship in a large open field away from trees and buildings. Tall grass in the field will prevent bad smashes too, but it

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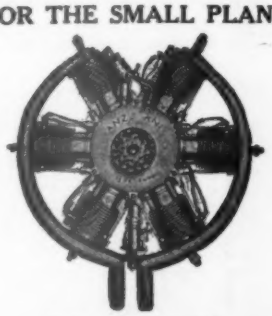

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does twist around a propeller hub occasionally.

Lost: One Record Model

Here we were at a very large National Contest. Hundreds of contestants were gathered in groups at Selfridge Field. The outdoor duration prizes were the stakes. There were many stop watches and timers, but the winning model was clocked many minutes short of its actual time as the judges were unable to follow it! Another "lost" model?

You remember *Popular Aviation* showed the model plan of little Jack Lefker's plane which won the junior outdoor contest at Memphis with a flight of over five minutes. It was followed by the officials in autos! Mr. Lucas of the Illinois Model Aero Club of Chicago, used a similar machine in winning the outdoor contest at Selfridge. It flew out of sight of the stationary timers at a little over four minutes, but continued on close to eleven minutes when it landed across the river over a mile away. It could have been followed by automobiles had they been available. Unfortunately, they were not, as the weather postponed the contest to a time when the police motorcycles which had been counted on were required at the Ford Airport to control the traffic at the start of the Balloon Race.

It is indeed unfortunate as the flight may have been a world record.

The plane was lost from sight even to Mr. Lucas for the last minute or so as the levee along the river obscured its landing. A Hawk from the First Pursuit Group at Selfridge went aloft and spotted the plane for the owner by a series of circles over the model and sharp dives.

Here again your model editor "crashed" into fame by motoring a group of Illinois Model Aero Club boys back to Mt. Clemmens where the only bridge was located and retracing the path along the river to where the Hawk had indicated. The car was parked and a search began. It was the model editor who found the model unharmed in some tall grass.

Mr. Lucas was very gracious and insisted on treating the party to the drinks in one of Detroit's (not Windsor's) best bars.

Mr. Lucas' fine model won him the much coveted Mulvihill Trophy for a year, $200.00 cash, a permanent cup, a gold medal, and temporarily but surely ended the discussion as to whether this was to be a three leg trophy or not. A proposition was started that the Mulvihill Trophy be-

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come permanently owned by either the individual or club which would win three years in succession starting with the 1926 contest. Of course, some believe that this three leg proposition should start from the very beginning of the Mulvihill contests in 1923. This would seem fairer to all than to start with any particular year, thereby discriminating against all previous winners. Perhaps the best way to settle the discussion would be to leave it a rotating annual trophy forever.

This would perpetuate one very desirable feature about model airplane competitions. The Mulvihill contest has no age limit, and therefore allows the very best talent of any age to gather together and compete in this most interesting event.

As it now stands, the trophy bears the names of:

Edward Lange, I.M.A.C., Winner at St. Louis, 1923.

Robert Jaros, I.M.A.C.,, Winner at Dayton, 1924.

Bertram Pond, I.M.A.C., Winner at New York, 1925.

Jack Loughner, A.M.L.A., Winner at Philadelphia, 1926.

Jack Loughner, A.M.L.A., 1927(?)

Joseph Lucas, I.M.A.C., Winner at Detroit, 1928.

As the Lucas machine is very similar to Lefker's model, we will not attempt any description of it at present except to say that it is a fine model and it is entirely constructed of balsa. "I" beams are used, of course.

Owes Two Cigars!

For a trip to Europe, $200.00 cash prize, $200.00 merchandise prize, a permanent trophy cup, a season trophy, a gold medal and many other honors, Aram Abgarian of Detroit owes a fair part of his good fortune to a feature found on your model editor's planes. Understand, the model editor claims only two cigars; but I am sure Aram would place considerably more value upon the feature he borrowed, if you would but ask him when he returns from Europe.

Aram's model created a new world's indoor duration record at the Olympia in Detroit before hundreds of spectators and officials at the National contest sponsored by the American Boy magazine: five minutes, fifty-three and six-tenths seconds, or three hundred fifty-three and six-tenths seconds. Think of it! It was a beautiful flight starting with two stalls, and tears came to Aram's eyes as only one more chance remained; but the innovation on his

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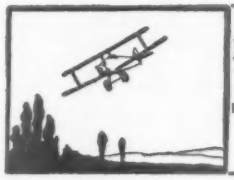

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1727 Sedgwick St. Chicago, Ill.

model (good for two cigars!) allowed the rather generous propeller to grasp the thin air on the third surge, and climb without further stalling. It was a slow, steady climb to the high ceiling, where his machine played tag with the steel work knocking dust and dirt down on his competitors. Finally the rubber spent its last revs, and the crowd, on its toes, sensed a new record and pressed forward, stirring the air a bit. A second, or perhaps more, was clipped from the glide by the anxious spectators. A cheer went up when the lad's model touched the floor, literally smashing the old three hundred thirty-one seconds record in one consistent flight. Then Aram wisely placed his pretty model inside the fine leather suit case which he uses as a hangar.

There were others who had fine models in every respect, except—well, Aram had one feature which the others simply had never figured out. They tried rubber lubricants and everything possible to beat his record. Only one had half a chance, and a large girder reached out and held his model fast to save him the trouble of wondering why Aram's machine was really better.

Even this does not tell the whole story. Aram worked all night to get his model in shape for the big event. He had his mother keep him awake so that he could carry on, but at three A. M. she fell asleep. However, he felt wide awake enough to go on till morning without awakening her.

Fellows, that is perseverance! If you catch the spirit and idea of it, it is worth more to you than all of the model articles ever printed!

Soon, the model section will show a model very close in outline and detail to Aram's fine little ship. He allowed me to examine and handle his plane, so I can give you the general ideas—except the special one which Aram asked me to go slow on. Watch for it! And also for a fine commercial model.

The Lucas Model

We have hopes of persuading Mr. Joseph Lucas, the member of the Illinois Aero Club who made the remarkable flight mentioned previously in this article, to furnish POPULAR AVIATION with some of the details of his model. Many of them have been shown in previous issues of POPULAR AVIATION. Mr. Lucas coached Jack Lefker, who ran away with the prizes at Memphis last October, and is an old-time builder of great experience.

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Books on Aviation

(*Continued from page 36*)

The text is plentifully illustrated with charts and formulae; but as he clearly explains each step which is taken, it isn't quite as difficult as many other books I have "muddled" through. At any rate, I'm not an engineer and shouldn't be reading books of this nature, but an engineer lives and exists on material such as this.

It is rather disheartening to read pages and pages of eulogy with really nothing about the actual incidents of the happening or the promotion of some certain enterprise. The authors of some books disregard the intelligence of their readers by writing reams about certain points which anyone can very readily understand.

But, *Heroes of the Air*, by Chelsea Fraser (Crowell—$2.00) seems entirely apart from the dry style of bringing the above to you in close contact. He writes in such a fashion that you feel as though the individual who has made the flight is speaking to you, describing the thrills, happiness, and terrors of his trip. For instance, when Alcock and Brown made the first non-stop Atlantic flight, the conversation which takes place between the two on the way over, is given and anyone can sense the thrills that they experienced. When Brown saw land, and said: "I say, Jack, if that isn't Eastal Island over yonder, dead ahead, I'll drink this jolly ocean at one gulp," you feel happy with him. That is the purpose of reading—to forget yourself and everything connected with you, and to feel that you are in the cockpit of the plane speeding along through darkness, storms and fog.

Any well-written text, of constructive help to the layman who wishes a source of knowledge entirely apart from all disheartening formulae, is considered worth-while, for, simplicity, after all, is the finest art in writing.

Such a text is the *Aircraft Handbook* by Colvin & Colvin (McGraw-Hill, $4.00). The authors have not restricted their scope to one limited subject, but have covered the field in general. The edition (1928) has its value in that the material offered is not obsolete and worthless to readers who are anxious to understand aviation as it is today. Chambers of Commerce will find information on the construction of airports; mechanics, complete chapters on the latest type of airplane engines, with advice on "trouble shooting"; fledging pilots, a chapter devoted to air commerce regulations, aircraft instruments and up-to-date nomenclature. The layman, of course, is mildly interested in all of the above subjects and can spend quite a few of his leisure hours, digesting the material.

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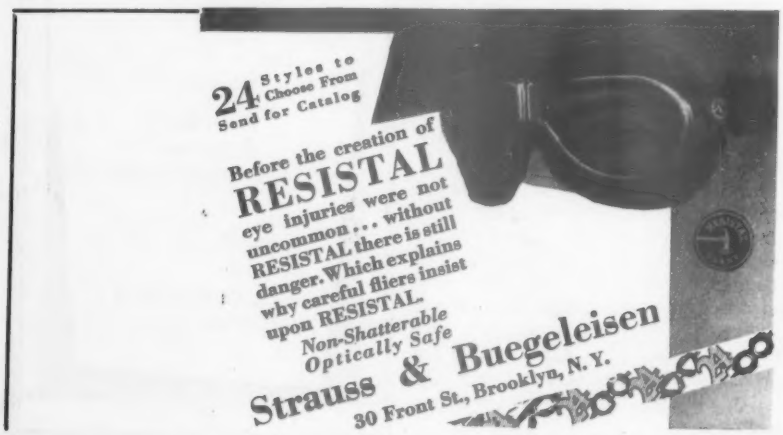
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Aero Club News

(*Continued from page 70*)

Paterson, N. J.

One of the most active high school units in this country is the Central Aero Club of Central High School, Paterson, N. J. There are over twenty-five active members in this unit, and inasmuch as the Wright Aeronautical Company, the Gates-Day Aircraft Company and the very strong Paterson Aero Club are striving to make Paterson the air city of the country, it readily may be seen that boys in the Central High School become air-minded very rapidly.

Laurel Springs, N. J.

At its last meeting the aviation group of Laurel Springs, N. J., of which McCullough C. Case has been an active worker, decided on the name of "Camden County Aero Club" as a name under which the club will continue. This organization is a most active one, and as they are covering an extensive territory and already have enrolled in their membership some of the outstanding figures in their section, it is fair to assume that within this year the Camden County Aero Club will make very rapid strides. The officers elected are: President, James S. Reynolds; Vice-President, Paul MacIntyre; Recording Secretary, William Burrows; Corresponding Secretary, McCullough C. Case; Treasurer, Herbert Beattie; Financial Secretary, LeRoy Moore; Sergeant-at-Arms, Arthur Arndt.

Peoria, Ill.

The Peoria Aero Club of Peoria, Ill., continues to show the way to other aero units throughout the country. Co-operating with local interests, this unit recently held an air carnival on the local field at which thirty thousand persons were in attendance. The purchase of a plane has been made by this organization and its club members in the short space of their organization have done much to make Peoria one of the real air-minded communities in this country. Louis Davis, Jr., is the active president and shortly expects to be a very active flier.

Pioneer Air Pilots

(*Continued from page 50*)

lived in luxury. The wandering gypsy life was his perennial love.

Curious streaks of sentiment cropped out occasionally. While on one of his early trips around the world he had to decide whether his heir should be born in China or on American soil. Without hesitation he cancelled his contracts, and immediately started for his home in Quincy where the baby was born. On his keyring he carried one of his most cherished possessions: a battered, strange looking key that was out of place among the rest. It was his switch key and carried his memory back to his youthful days as a brakeman on the old Illinois R. R.

A little group stood about a hydroplane that floated on the surface of lovely Lake Keuka, not far from Hammondsport, N. Y. A medium statured, stockily built, rugged-faced man of indeterminate age skipped

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with amazing agility for his bulk over the shifting teetering float and took his seat in the boat under the wings. As the machine was pushed into deeper water John McCurdy, the man who made the first flight from Key West to Havana, turned to Curtiss:

"The Captain has never flown a hydro. Isn't it unsafe to let him go up in it alone?"

"Afraid to let Uncle Tom fly?" Curtiss grinned. "I'd just as soon think of being afraid to let Mrs. Curtiss wheel our little boy down the street in the perambulator. If there is anything that has wings on it that can carry a man into the air, and the Captain can't fly it, I want to see it."

Nevertheless, Baldwin's thoughts reverted to one of his old loves. Dirigibles were again engrossing his attention. On the 5th of May, 1914, he sailed for Europe on the Baltic on an extensive tour of inspection of the latest foreign developments in aeronautics. Shortly after his return the war broke out.

Curtiss had established a flying school at Newport News, Virginia, and Baldwin went there as manager. Upon the entry of the United States into the war he immediately volunteered his services, and in spite of his age he was commissioned a Captain in the Aviation Section on April 25, 1917. He was at once assigned to the post of Chief of Army Balloon Inspection and Production, and he served in that capacity until October, 1919, when he was honorably discharged from active service. On the previous June he had attained the rank of Major.

After his release from the Army he was attached to the Army Air Service in a civilian capacity at Akron, Ohio.

The N. Y. Times of May 18, 1923 carried the following brief obituary:

"Major Thomas Scott Baldwin died in the Deaconess's Hospital, Buffalo, N. Y., on May 17, 1923 at the age of sixty-eight."

The old timers bowed their heads at the passing of their comrade. But one thing is certain; though the Army gave him the title of Major he will live in their memories: not as Major Thomas Scott Baldwin. Never! He is memorialized in the affectionate phrase "Old Cap Baldwin."

Dodo Days

(*Continued from page* 44)

very short time preceding a spin would shout instructions.

My first instructor was a mighty good fellow and was a fine instructor. His manner was not harsh, as was the case with a good many of the others, and he would tell one of his mistakes in a confiding manner and would make one feel like doing one's darndest to progress as was required of each student. One day I was feeling quite fine and the ship just seemed as a toy in my hands and after making several take-offs and landings and doing the turns with the nose on the horizon I really thought that I was rather good. Either I was better than I knew how, according to that rather famous expression, or the good work went to my head, but I was never as good as that any time thereafter. I began to feel that I was on sinking sand and that I would have to snap out of it or I would be leaving the school as many others were about to do. (Next and last installment on "Riding a Wash-out.)

Switzerland in the Air

(*Continued from page* 31)

that leaves quite early in the morning does not reach Basle until nearly noon and the plane that leaves at a quarter before eight reaches Basle at nine twenty every day. This passenger is typical of many of those whom these commercial planes carry in Switzerland. In many cases the writer has met business men who use the commercial plane regularly

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and much of its patronage comes from this source.

Commercial flying in Switzerland is well established and has a steady following and the co-operation of other nations that have helped her present development. For a small country her air lines are very creditable and operate very efficiently and have an excellent record behind them.

Cloud Signs

(*Continued from page 23*)

Cumulus clouds have already been described.

Stratus clouds are merely horizontal sheets of fog varying in altitude but usually under 3,000 feet. Sometimes stratus clouds are merely a s e a - f o g drifting over relatively warmer land. They may be caused by cold air under-running warm, moist air and cooling it. They may be caused merely by cooling due to radiating the heat of the air originally containing the water-vapor or by the gentle mixing of cold and warm, moist air. Fracto-stratus clouds are bits of a stratus cloud which has been shredded by the winds or broken up by the summits of mountains.

A nimbus is a thick, extensive layer of flat cloud from which rain or snow is falling. The average altitude of its lower surface is about 3,000 feet, although it is often much lower. Through openings in it an upper layer of cirro-stratus or alto-stratus may often be seen. It may be formed in any of the ways possible in the lower cloud region. Obvious fracto-nimbus clouds are detached fragments of nimbus. These fog-like clouds, commonly termed scuds, are usually seen lighter than the dark background of the nimbus. These are usually drifting rapidly at altitudes between 300 and 1,000 feet. They seem to form only when a strong wind is blowing. The cumulo-nimbus—the thunderhead—was described at length in a previous article.

Besides these primary clouds there are many special forms in locations peculiar to them. False cirrus clouds may sometimes be seen floating above a thunderhead. As one watches the towering, mountainous clouds of a thunderhead toward the distant horizon he will note many formations grow and disappear. The typical anvil cloud rises out of this mass with feathery edges quite different from the cauliflower heads of the boiling crests. One may see a layer cloud hanging over an island or a flag-like cloud flying from a mountain-top. Clouds may be floating shoreward from over a body of water. Watch them on a hot, sunny day. Perhaps they will be torn violently upward when they reach a point over the land.

All the fundamental reasons for these formations and antics have been described in preceding paragraphs. Let the reader practice diagnosing these things. Watch the weather reports in the newspapers and consult the weather maps. Note the wind direction, the humidity, and the barometer. All this is interesting—and useful—whether one flies or merely plans an automobile tour. Weather is such a part of our environment and has such influence upon many details of our lives that one should be weather-wise. To be cloud-wise is the greatest step. Then to all this usefulness is added the pleasure of the beauty and variety which the sky affords. The sky is an interesting companion that goes with us everywhere—not only along cloudland trails, but to our work and to our play. It is framed in the window of work-shop, office or home. It spreads over every outdoor scene. It can tell us much and it can make life more interesting.

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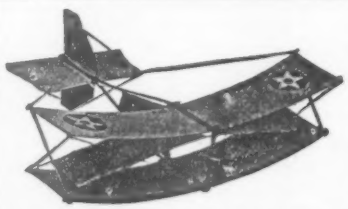

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X. Pratt & Whitney Wasp Engine;
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Index to Advertisers

Ace Aeroplane & Model Supply Co. 85
Advance Aircraft Co..... 59
Aero Kite Co..... 94
Aero Model Co..... 99
Aeronautica 94
Airsled Co., The 88
Air Transport Equipment, Inc. 75
Alexander Aircraft Co. 73, 100
American Eagle Aircraft Corporation 55
American School of Aviation 8
American Society for Promotion of Aviation 81
Ancient Art Metal Co..... 78
Austin Company, The..... 10
Aviation Engineering School 94
Aviation Institute of U. S. A. 57
Aviator Goggle Co..... 87
Aviation Service and Transport, Inc. 80

Barrett Airways, Inc..... 88
Beck Distributing Corporation 4, 94
Becker's 89
Bennett Eaglerock Sales Co. 95
Brownback Motor Laboratories, Inc. 87

Cessna Aircraft Co..... 2
Chicago Salvage Stock Store 91
Clinton Toy Co..... 85
Commercial Aircraft Sales 86
Commercial Aviation Co., Inc. 88
Consolidated Instrument Company of America.. 87
Crowdus, Walter C..... 94

Eagle Airport School of Aviation 94

Fairchild Aviation Corporation 3, 5
Fleischmann Transportation Co. 85
Flug-Woche 94

Greer College of Automotive Engineering 61

Heath Airplane Co..... 89
Henley Publishing Co., Norman W. 69
Hotel Detroit Leland..... 93
Hotel Eastgate 92
Hotel Hamilton 92
Hotel Lexington 90
Hotel Paul Revere 90
Hotel Piccadilly 89
Hotel Roosevelt 90

Ideal Aeroplane & Supply Co. 84
Irwin Aircraft Co. 88

Johnson Co. 94
Johnston, Lt. H. W..... 95

Lancaster & Allwine..... 94
Lincoln Airplane School 96
Ludington Philadelphia Flying Service, Inc..... 95

McGraw-Hill Book Co., Inc. 98
Marr, T. 97
Marshall Flying School.. 53
Meyer, Inc., N. S..... 91
Meyrowitz, Inc., E. B..... 79
Mid-Plane Sales & Transit Co. 6
Monarch Aircraft Co..... 91
Mount Carmel Mfg. Co... 84

National Airways System 51
National Aviation Training 86
National Aero Club..... 94
National Aero Corporation 97
National Radio Institute 86
Nims Co., C. Harry..... 87
Northrop Airplane Co... 47

Parks Air College.....49-71
Peru Model Airplane Shop 84
Polachek, Z. H. 88
Porterfield Flying School 45
Posey & Co., J. V. G..... 94
Prouty Motor Co..... 89

Rankin System Incorporated 37
Revelation Aircraft Co... 94
Robertson Flying Services, Inc. 41
Roth Downs Airways, Inc. 63

Simplex Air Model Co... 84
Spartan Aircraft Co..... 43
Strauss & Buegeleisen.... 90
Swallow Airplane Co..... 67

Taylor Brothers Aircraft Corp. 88
Travel Air Manufacturing Co. 39

U. S. Aviation School.... 90
U. S. Model Aircraft Corp. 85
Universal Air Service.... 95
United States Standard Airport Construction Co. 94

Van Deventer, Inc., H. R. 89
Von Hoffman Aircraft School 65

Wallace Aircraft Co..... 73

Yancey, Capt. Lewis A... 77

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